

1977

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INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION

APPOINTED UNDER A CONVENTION
BETWEEN CANADA AND THE UNITED STATES FOR THE
PROTECTION, PRESERVATION AND EXTENSION OF
THE SOCKEYE AND PINK SALMON FISHERIES
IN THE FRASER RIVER SYSTEM

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ANNUAL REPORT

1977

COMMISSIONERS

W. R. HOURSTON
RICHARD A. SIMMONDS

DONALD R. JOHNSON
WILLIAM G. SALETIC
GORDON SANDISON

NEW WESTMINSTER
CANADA
1978

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AND PERIOD OF SERVICE
SINCE THE INCEPTION OF THE COMMISSION
IN 1937

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Senator Thomas Reid	1937-1967
A. J. Whitmore	1939-1966 1968-1969
Olof Hanson	1948-1952
H. R. MacMillan, C.B.E., D.Sc. .	1952-1956
F. D. Mathers	1956-1960
W. R. Hourston	1960-
Richard Nelson	1966-1976
Roderick Haig-Brown	1970-1976
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B. M. Brennan	1937-1942
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Fred J. Foster	1943-1947
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Elton B. Jones	1951-1957
Arnie J. Suomela	1954-1961
DeWitt Gilbert	1957-1974
George C. Starlund	1961-1966
Clarence F. Pautzke	1961-1969
Thor C. Tollefson	1966-1975
Charles H. Meacham	1969-1970
Donald R. Johnson	1971-
William G. Saletic	1974-
Donald W. Moos	1975-1977
Gordon Sandison	1977-

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DIRECTOR — A. C. COOPER

ASSISTANT DIRECTOR — J. F. ROOS

NEW WESTMINSTER
CANADA
1978

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REPORT OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1977

The Annual Report for 1974 described some of the changes that have taken place in the sockeye fishery over a period of 20 years and the effects of these changes on the traditional net fisheries within Convention Waters. In 1977 a substantial increase occurred in the proportion of the harvest of pink salmon by Canadian troll fisheries in Convention Waters west of the Bonilla-Tatoosh Line. This troll catch amounted to 47.3% of the Canadian Convention Waters catch of pink salmon, compared to the previous high of 24.8% in 1969 (Table 1). The 1977 Canadian West Coast troll catch in Convention Waters exceeded the previous record catch made in 1967, and the exploitation rate of 13.65% was the highest yet recorded (Table 2).

Table 1. Canadian troll catch of pink salmon in Convention Waters west of Bonilla Line and percentage of Canadian Convention Waters catch.

<i>Year</i>	<i>Troll Catch*</i>	<i>Canadian Convention Waters Catch</i>	<i>Percent Troll</i>
1957	40,867	2,634,720	1.55
1959	186,295	2,312,906	8.05
1961	54,161	545,128	9.94
1963	350,749	4,173,288	8.40
1965	68,544	592,467	11.57
1967	920,092	4,156,922	22.13
1969	213,920	861,505	24.83
1971	420,309	2,137,337	19.67
1973	415,476	2,060,679	20.16
1975	222,675	1,255,890	17.73
1977	982,517	2,075,478	47.34

* Data for years 1969-77 includes small catches in Area 20.

Table 2. Exploitation of pink salmon by Canadian troll fisheries in Convention Waters west of the Bonilla-Tatoosh Line.

	1959	1961	1963	1965	1967	1969	1971	1973	1975	1977
Total Stock Available in Convention Waters (millions)	6.31	3.47	15.46	2.99	10.00	3.21	6.60	6.25	3.80	7.20
Troll Exploitation (percent)	2.95	1.56	2.27	2.29	9.20	6.66	6.37	6.65	5.86	13.65

As a consequence of the higher exploitation rate and the smaller stock size, the outside troll catch proportion of the catch in 1977 was over twice as large as in 1967. The catch by Canadian trollers north of Convention Waters in 1977

was a record 832,100 pinks, nearly double the catch in 1967, and the percentage of Canadian harvest of pinks made in this area reached a record 28.62% (Table 3). The increases in troll catch since 1957 have resulted in a decline in the percentage of harvest of southern approach pinks by Canadian fishermen in Convention Waters east of the Bonilla Line from 97% in 1957 to 37.6% in 1977.

Table 3. Catches of pink salmon from southern approach stocks by Canadian fishermen in Convention Waters and in the non-Convention Waters troll fishery.

Year	Convention Waters				Non-Convention Waters		
	East of Bonilla	%	West of Bonilla Troll	%	Lat. 48°N to Cape Scott Troll*	%	Total
1957	2,593,853	97.07	40,867	1.53	37,500	1.40	2,672,220
1959	2,126,611	87.02	186,295	7.62	130,960	5.36	2,443,866
1961	490,967	77.81	54,161	8.58	85,870	13.61	630,998
1963	3,822,539	86.70	350,749	7.96	235,576	5.34	4,408,864
1965	523,923	82.66	68,544	10.81	41,397	6.53	633,864
1967	3,236,830	70.73	920,092	20.10	419,437	9.17	4,576,359
1969	647,585	56.28	213,920	18.58	289,727	25.17	1,151,232
1971	1,717,028	64.54	420,309	15.80	523,222	19.68	2,660,559
1973	1,645,203	66.65	415,476	16.83	407,843	16.52	2,468,522
1975	1,033,215	61.57	222,675	13.27	422,320	25.16	1,678,210
1977	1,092,461	37.58	982,517	33.79	832,332	28.63	2,907,310

* Data from Canada Fisheries Service.

The increasing share of catch by the outside troll fishery and the decreasing share of catch by the inside net fisheries in all Convention Waters is of great concern to the net fishermen. The net fisheries are subject to restrictive weekly regulations to obtain division of catch and the required escapement, whereas the outside troll fishery is subject only to an overall season regulation. The net fishermen have advised the Commission of their contention that regulatory control for management of the sockeye and pink salmon stocks should apply to the outside troll fisheries also. The Commission has been concerned about this question for a number of years and has advised the governments of this concern on two occasions. Starting in 1971, the troll fishery in Area 20 has been limited to the same days as the net fishery during the period of Commission control. Regulations applicable to the Convention Waters west of the Bonilla-Tatoosh Line could be recommended, but such regulations probably would be of little practical value if the adjacent non-Convention Waters were not similarly regulated. The Commission believes, as a matter of principle, that all fisheries in Convention Waters should be subject to management requirements for conservation and division of catch. The relative freedom of the troll fishery from management controls to date, if continued, will have increasing impact on the inside net fisheries.

COMMISSION MEETINGS

The International Pacific Salmon Fisheries Commission held twenty-two formal and twenty-one telephone meetings during 1977 with the approved minutes of the meetings being submitted to the Governments of Canada and the United States.

Commissioner Donald W. Moos resigned in September 1977 and Mr. Gordon Sandison, Director of Washington State Department of Fisheries, was appointed the new United States Commissioner. At the end of 1977, the Commission membership was as follows:

<i>Canada</i>	<i>United States</i>
W. R. Hourston	Donald R. Johnson
Richard A. Simmonds	William G. Saletic
	Gordon Sandison

At the February 4 meeting, the Commission appointed Mr. Tom Philpott as alternate member of the Advisory Committee for the balance of Mr. Glenn Schuler's appointment representing United States Reef Net Fishermen. The Commission also approved the appointment of Mr. Gerald Simmons for another four-year term as Advisory Committee member representing United States Troll Fishermen. Advisory Committee member Mr. Lloyd Monk passed away suddenly on March 4 and Mr. Jack O'Connor was appointed June 27 to complete the term as the Canadian representative for Salmon Processors. At the end of 1977, the membership of the Advisory Committee was as follows:

<i>Canada</i>	<i>United States</i>
J. Brajcich Purse Seine Fishermen	W. Green Purse Seine Fishermen
J. O'Connor Salmon Processors	D. Franett Salmon Processors
F. Nishii Gill Net Fishermen	R. Christensen Gill Net Fishermen
N. Carr Purse Seine Crew Members	T. Philpott Reef Net Fishermen
M. Guns Troll Fishermen	G. Simmons Troll Fishermen
H. English Sport Fishermen	E. Engman Sport Fishermen

The first meeting of 1977 was held February 4 with Mr. Donald R. Johnson serving as Chairman and Mr. W. R. Hourston as Vice-Chairman and Secretary. The Commission met with government officials and the Advisory Committee regarding the tentative recommendations for regulatory control of the 1977 sockeye and pink salmon fishery in Convention Waters, as submitted to the Committee by the Commission on December 10, 1976. The regulations were moved for adoption as submitted to the industry on December 10, 1976, but failed to get the

required approval of the Commission. Further discussion of the regulations was deferred until the next Commission meeting. The Commission met with the Secretary of the Pension Society and approved the revised retirement proposal of the Society.

On March 25 the Commission met with the Advisory Committee to discuss a proposal from the United States Government to amend the Commission's tentative regulations. After discussion, the proposal was unanimously opposed by all the Advisory Committee and it was the consensus of the Advisory Committee that the Commission should proceed with the regulations it had submitted to the industry at the December 1976 Annual Meeting. The Commission agreed that the Commissioners of each country should discuss this matter further with their respective governments. The budget for fiscal year 1977-78 was approved by the Commission.

The Commission met at Chilko Lake on May 6 to view the sockeye fry and smolt migrations. The draft for the 1976 Annual Report was approved.

On June 1 the Commission met in Richmond, British Columbia, to discuss the proposed 1977 regulations. The Commission reviewed comments made by the Advisory Committee at the February 4 meeting and after certain revisions, approved the recommended regulations for submission to the two national governments. The Commission approved a recommendation to the Minister of Fisheries and the Environment that the Indian Food Fishery at the Nautley and Stella Reserves be limited to one day per week from July 25 to August 10, to protect the escapement of the Early Nadina sockeye.

The Commission met June 27 and reviewed correspondence that was received from the United States Government approving the Commission's regulations for the 1977 sockeye and pink salmon fishery in Convention Waters, with the exception of United States Indians, "who are entitled to exercise fishing rights by virtue of treaties with the United States in United States Convention Waters and are fishing in accordance with federal regulations providing for the exercise of such fishing rights".

The Commission also discussed regulations from the Federal Register by the National Marine Fisheries Service and the Bureau of Indian Affairs concerning Indian fishing time in United States Convention Waters. The Commission also approved an emergency order that its regulations for 1977 in United States Convention Waters apply to all citizens without exception.

During the period July 4 to October 7 inclusive, the Commission held fourteen formal and twenty-one telephone meetings for adjustment of fishing regulations to achieve the desired escapement and, as nearly as practicable, equitable division of the allowable catch of Fraser River sockeye and pink salmon.

On July 8 the Commission met with a representative of Washington State Department of Fisheries to review the State's catch reporting procedures. On July 15 the Commission met with representatives of the State, the Bureau of Indian Affairs and the National Oceanic and Atmospheric Administration to discuss the catch reporting question. On July 22 the Commission passed an Emergency Order that when fishing is closed under Commission regulations, the catching or taking of sockeye and pink salmon is prohibited. On August 11 the Commission met with its Advisory Committee and representatives of the governments of Canada and the United States to discuss the action of the United States with respect to the Commission's regulations for 1977 and other factors bearing on the management of the sockeye and pink runs by the Commission. On August 26 the Commission, accompanied by members of the Advisory Committee, inspected the sockeye spawning in the Horsefly River system.

The Commission met October 18 in Bellingham to discuss the problems associated with the unreported catches of sockeye salmon in the commercial fishing area in the Fraser River. It was ascertained that 140,000 sockeye be added to the Canadian catch on this account. A review was made of the troll fishery catches of sockeye in 1974 and of pink salmon in 1977 in Canadian Convention Waters, to consider the problems that may be encountered in 1978.

The Commission met on December 2 to review the Annual Meeting presentation. The twenty-second and final formal meeting of the year was held on December 9 in Vancouver, British Columbia, when the Commission held its Annual Meeting with its Advisory Committee and approximately 400 representatives of industry, government and press. Regulatory problems that occurred during 1977 were reviewed by the Chairman and Vice-Chairman. The catch and escapement statistics for the 1977 sockeye and pink salmon season were presented by the staff. Reports were also presented on the following topics: 1. Production of sockeye and pink salmon from Commission spawning channels; 2. Even year pink salmon research, lake productivity studies, prespawning mortality of Horsefly sockeye, and occurrence of IHN disease in Chilko sockeye; 3. Protection of the environment; and 4. Engineering investigations, including flood damage to Weaver Creek spawning channel. Prospects for the 1978 fishing season were reviewed and tentative regulations for the 1978 fishery were proposed for consideration by the industry and their representatives on the Commission's Advisory Committee.

1977 REGULATIONS

Recommendations for regulations governing the 1977 sockeye and pink salmon fishery in Convention Waters were adopted at a meeting of the Commission held on June 1, 1977 and were submitted to the two national governments for approval on June 1, 1977. The recommendations for Canadian Convention Waters were implemented during the fishing season under the Fisheries Act, British Columbia Fishery Regulations and subsequently by Order-in-Council dated November 24, 1977. On June 17, 1977, the United States Government informed the Commission regarding its recommended 1977 regulations as follows: "The United States Government has approved the recommended regulations except as

to U.S. Indians who are entitled to exercise fishing rights by virtue of treaties with the United States in U.S. Convention Waters and are fishing in accordance with Federal regulations providing for the exercise of such fishing rights." The National Marine Fisheries Service was designated as the enforcing agency in cooperation with other federal agencies.

The recommendations of the Commission were as follows:

Canadian Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends that, in the interests of such fisheries, the following Fraser River Sockeye and Pink Salmon Fishery Regulations for the season of 1977 be adopted by Order-in-Council pursuant to Section 34 of the Fisheries Act, namely:

1. (1) No person shall fish for sockeye or pink salmon in the waters of the southerly portion of District No. 3 in that portion of Area 20 lying westerly of a line drawn true south from Sheringham Point Lighthouse to the International Boundary with nets from the 26th day of June, 1977 to the 23rd day of July, 1977, both dates inclusive.

(2) No person shall fish for sockeye or pink salmon with purse seines in the waters described in subsection (1) of this section:

(a) From the 24th day of July, 1977 to the 30th day of July, 1977, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday; and

(b) From the 31st day of July, 1977 to the 3rd day of September, 1977, both dates inclusive, except from half past six o'clock in the forenoon to half past six o'clock in the afternoon of Monday and Tuesday of each week; and

(c) From the 4th day of September, 1977 to the 17th day of September, 1977, both dates inclusive, except from seven o'clock in the forenoon to seven o'clock in the afternoon of Monday and Tuesday of each week.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 24th day of July, 1977 to the 30th day of July, 1977, both dates inclusive, except from half past six o'clock in the afternoon of Monday to half past six o'clock in the forenoon of Tuesday; and

(b) From the 31st day of July, 1977 to the 3rd day of September, 1977, both dates inclusive, except from half past six o'clock in the afternoon of Monday to half past six o'clock in the forenoon of Tuesday; and from half past six o'clock in the afternoon of Tuesday to half past six o'clock in the forenoon of Wednesday of each week; and

(c) From the 4th day of September, 1977 to the 17th day of September, 1977, both dates inclusive, except from seven o'clock in the afternoon of Monday to seven o'clock in the forenoon of Tuesday; and from seven o'clock in the afternoon of Tuesday to seven o'clock in the forenoon of Wednesday of each week.

(4) No person shall troll commercially for sockeye or pink salmon in the waters described in subsection (1) of this section from the 24th day of July, 1977 to the 17th day of September, 1977, both dates inclusive, except at times that net fishing may be permitted within that area.

2. No person shall fish for sockeye or pink salmon with nets in the waters of the southerly portion of District No. 3 embraced in Areas 17 and 18:

(1) From the 26th day of June, 1977 to the 16th day of July, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(2) From the 17th day of July, 1977 to the 6th day of August, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week; and

(3) From the 7th day of August, 1977 to the 27th day of August, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(4) From the 28th day of August, 1977 to the 10th day of September, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week, in the following described waters:

(a) The waters lying westerly of a straight line drawn from Thrasher Rock Light to Law Point on Gabriola Island, thence along the easterly shoreline of Gabriola Island to Josef Point, thence in a straight line to Cordero Point on Valdez Island and along the easterly shoreline of Valdez Island to Vernaci Point, thence in a straight line to Race Point on Galiano Island and along the easterly shoreline of Galiano Island to Burrill Point, thence in a straight line to Georgina Point on Mayne Island, thence along the easterly shoreline of Mayne Island to Campbell Point, thence in a straight line to Winter Point on Saturna Island, thence along the easterly shoreline of Saturna Island to East Point, thence due south in a straight line to the International Boundary.

3. No person shall troll commercially for sockeye or pink salmon in that portion of the waters described in section 2 lying easterly of a line from Thrasher Rock Light, thence in a straight line to Salamanca Point on the southerly end of Galiano Island, thence in a straight line to East Point on Saturna Island, thence due south in a straight line to the International Boundary, from the 7th day of August, 1977 to the 27th day of August, 1977, both dates inclusive, except at the times and locations that net fishing may be permitted within that area.

4. No person shall troll commercially for sockeye or pink salmon in that portion of the waters described in section 2 lying easterly of a straight line from Thrasher Rock Light to Law Point on Gabriola Island, thence along the easterly shoreline of Gabriola Island to Josef Point, thence in a straight line to Cordero Point on Valdez Island and along the easterly shoreline of Valdez Island to Vernaci Point, thence in a straight line to Race Point on Galiano Island and along the easterly shoreline of Galiano Island to Burrill Point, thence in a straight line to Georgina Point on Mayne Island, thence along the easterly shoreline of Mayne Island to Campbell Point, thence in a straight line to Winter Point on Saturna Island, thence along the easterly shoreline of Saturna Island to East Point, thence due south in a straight line to the International Boundary, from the 28th day of August, 1977 to the 10th day of September, 1977, both dates inclusive.

5. No person shall fish for sockeye or pink salmon with nets or by commercial trolling in that portion of the waters described in section 2 lying easterly of a straight line from Thrasher Rock Light to Law Point on Gabriola Island, thence along the easterly shoreline of Gabriola Island to Josef Point, thence in a straight line to Cordero Point on Valdez Island and along the easterly shoreline of Valdez Island to Vernaci Point, thence in a straight line to Race Point on Galiano Island and along the easterly shoreline of Galiano Island to Burrill Point, thence in a straight line to Georgina Point on Mayne Island, thence along the easterly shoreline of Mayne Island to Campbell Point, thence in a straight line to Winter Point on Saturna Island, thence along the easterly shoreline of Saturna Island to East Point, thence due south in a straight line to the International Boundary, from the 11th day of September, 1977 to the 30th day of September, 1977, both dates inclusive.

6. No person shall fish for sockeye or pink salmon with gill nets in the Convention Waters portion of District No. 1:

(1) From the 26th day of June, 1977 to the 16th day of July, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(2) From the 17th day of July, 1977 to the 6th day of August, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Wednesday of each week; and

(3) From the 7th day of August, 1977 to the 10th day of September, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week; and

(4) From the 11th day of September, 1977 to the 24th day of September, 1977, both dates inclusive, except from eight o'clock in the forenoon of Monday to eight o'clock in the forenoon of Tuesday of each week in the following described waters:

(a) Those waters lying westerly of a line projected from Point Grey to the westerly end of the North Arm Jetty, thence to Sandheads Light and thence to the International Boundary at the junction of District No. 1 and Area 17 and Area 18; and

(5) From the 25th day of September, 1977 to the 8th day of October, 1977, both dates inclusive.

7. No person shall troll commercially for sockeye or pink salmon in that portion of the waters described in section 6 lying east and south of a straight line projected from Gower Point at the westerly entrance to Howe Sound to Thrasher Rock Light, from the 7th day of August, 1977 to the 30th day of September, 1977, both dates inclusive, except at the times and locations that net fishing may be permitted within that area.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

United States Convention Waters

"The International Pacific Salmon Fisheries Commission appointed pursuant to the Convention between Canada and the United States of America for the protection, preservation and extension of the Sockeye Salmon Fisheries of the Fraser River System, signed at Washington on the 26th day of May, 1930, as amended by the Pink Salmon Protocol signed at Ottawa on the 28th day of December, 1956, hereby recommends to the United States Government that regulations to the following effect in the interest of such fisheries, be adopted for the year 1977, and that an approved copy of said regulations be forwarded to the Director of Fisheries of the State of Washington for implementation by virtue of authority in him vested by Section 6 of Chapter 112 of the Laws of the State of Washington of 1949, namely:

1. (1) No person shall fish for sockeye or pink salmon with purse seines in the Convention Waters of the United States of America lying westerly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia:

(a) From the 26th day of June, 1977 to the 13th day of August, 1977, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday of each week; and

(b) From the 14th day of August, 1977 to the 17th day of September, 1977, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week.

(2) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 26th day of June, 1977 to the 2nd day of July, 1977; from the 10th day of July, 1977 to the 16th day of July, 1977; from the 24th day of July, 1977 to the 30th day of July, 1977; and from the 7th day of August, 1977 to the 13th day of August, 1977, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to half past nine o'clock in the forenoon of Wednesday of each week; and

(b) From the 3rd day of July, 1977 to the 9th day of July, 1977; from the 17th day of July, 1977 to the 23rd day of July, 1977; and from the 31st day of July, 1977 to the 6th day of August, 1977, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday and from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1977 to the 20th day of August, 1977; from the 28th day of August, 1977 to the 3rd day of September, 1977; and from the 11th day of September, 1977 to the 17th day of September, 1977, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday and from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week; and

(d) From the 21st day of August, 1977 to the 27th day of August, 1977; and from the 4th day of September, 1977 to the 10th day of September, 1977, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday and from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon with commercial trolling gear in the waters described in subsection (1) of this section from the 26th day of June, 1977 to the 17th day of September, 1977, both dates inclusive, except from Monday to Friday of each week on those days when purse seine fishing is permitted within that area.

2. (1) No person shall fish for sockeye or pink salmon with purse seines in the Convention Waters of the United States of America lying easterly of a straight line drawn from Angeles Point in the State of Washington across Race Rocks to William Head in the Province of British Columbia:

(a) From the 26th day of June, 1977 to the 13th day of August, 1977, both dates inclusive, except from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday and Tuesday of each week; and

(b) From the 14th day of August, 1977 to the 24th day of September, 1977, both dates inclusive, except from five o'clock in the forenoon to nine o'clock in the afternoon of Monday and Tuesday of each week.

(2) No person shall fish for sockeye or pink salmon with reef nets in the waters described in subsection (1) of this section:

(a) From the 26th day of June, 1977 to the 2nd day of July, 1977; from the 10th day of July, 1977 to the 16th day of July, 1977; from the 24th day of July, 1977 to the 30th day of July, 1977; and from the 7th day of August, 1977 to the 13th day of August, 1977, all dates inclusive, except from seven o'clock in the afternoon to half past nine o'clock in the afternoon of Monday, from five o'clock in the forenoon to half past nine o'clock in the afternoon of Tuesday and from five o'clock in the forenoon to seven o'clock in the afternoon of Wednesday of each week; and

(b) From the 3rd day of July, 1977 to the 9th day of July, 1977; from the 17th day of July, 1977 to the 23rd day of July, 1977; and from the 31st day of July, 1977 to the 6th day of August, 1977, all dates inclusive, except from half past ten o'clock in the forenoon to half past nine o'clock in the afternoon of Sunday, from five o'clock in the forenoon to half past nine o'clock in the afternoon of Monday, and from five o'clock in the forenoon to half past ten o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1977 to the 20th day of August, 1977; from the 28th day of August, 1977 to the 3rd day of September, 1977; and from the 11th day of September, 1977 to the 17th day of September, 1977, all dates inclusive, except from half past ten o'clock in the forenoon to nine o'clock in the afternoon

of Sunday, from five o'clock in the forenoon to nine o'clock in the afternoon of Monday, and from five o'clock in the forenoon to half past ten o'clock in the forenoon of Tuesday of each week; and

(d) From the 21st day of August, 1977 to the 27th day of August, 1977; from the 4th day of September, 1977 to the 10th day of September, 1977; and from the 18th day of September, 1977 to the 24th day of September, 1977, all dates inclusive, except from seven o'clock in the afternoon to nine o'clock in the afternoon of Monday, from five o'clock in the forenoon to nine o'clock in the afternoon of Tuesday, and from five o'clock in the forenoon to seven o'clock in the afternoon of Wednesday of each week.

(3) No person shall fish for sockeye or pink salmon with gill nets in the waters described in subsection (1) of this section:

(a) From the 26th day of June, 1977 to the 2nd day of July, 1977; from the 10th day of July, 1977 to the 16th day of July, 1977; from the 24th day of July, 1977 to the 30th day of July, 1977; and from the 7th day of August, 1977 to the 13th day of August, 1977, all dates inclusive, except from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday and from seven o'clock in the afternoon of Tuesday to half past nine o'clock in the forenoon of Wednesday of each week; and

(b) From the 3rd day of July, 1977 to the 9th day of July, 1977; from the 17th day of July, 1977 to the 23rd day of July, 1977; and from the 31st day of July, 1977 to the 6th day of August, 1977, all dates inclusive, except from seven o'clock in the afternoon of Sunday to half past nine o'clock in the forenoon of Monday, and from seven o'clock in the afternoon of Monday to half past nine o'clock in the forenoon of Tuesday of each week; and

(c) From the 14th day of August, 1977 to the 20th day of August, 1977; from the 28th day of August, 1977 to the 3rd day of September, 1977; and from the 11th day of September, 1977 to the 17th day of September, 1977, all dates inclusive, except from six o'clock in the afternoon of Sunday to nine o'clock in the forenoon of Monday, and from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday of each week; and

(d) From the 21st day of August, 1977 to the 27th day of August, 1977; from the 4th day of September, 1977 to the 10th day of September, 1977; and from the 18th day of September, 1977 to the 24th day of September, 1977, all dates inclusive, except from six o'clock in the afternoon of Monday to nine o'clock in the forenoon of Tuesday, and from six o'clock in the afternoon of Tuesday to nine o'clock in the forenoon of Wednesday of each week.

3. (1) No person shall fish for sockeye or pink salmon with nets within the described waters of subsection (1) of section 2 lying southerly and easterly of a line projected from Dungeness Light to Smith Island Light to Lawson Reef Lighted Buoy to Northwest Island, thence due east to Fidalgo Island from the 14th day of August, 1977 to the 10th day of September, 1977, both dates inclusive, except with nets having mesh not less than 8 inches extension measure at times when fishing by each gear is permitted in State Fishing Area 7.

(2) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 2 lying northerly and westerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to Georgina Point Light at the entrance to Active Pass in the Province of British Columbia from the 28th day of August, 1977 to the 3rd day of September, 1977, and from the 25th day of September, 1977 to the 8th day of October, 1977, all dates inclusive.

(3) No person shall fish for sockeye or pink salmon with nets in that portion of the waters described in subsection (1) of section 2 lying westerly of a straight line drawn true south from the southeast tip of Point Roberts in the State of Washington (otherwise known as Lily Point) to the International Boundary from the 4th day of September, 1977 to the 24th day of September, 1977, both dates inclusive.

4. The foregoing recommended regulations shall not apply to the following United States Convention Waters:

(1) State Fishing Area 7B including Hale Passage and Bellingham Bay and all Convention Waters of Area 7B lying easterly and inside of a line projected from Carter Point on Lummi Island to the most northerly tip of Vendovi Island, thence to Clark Point on Guemes Island following the shoreline to Southeast Point on Guemes Island, thence to March Point on Fidalgo Island, and

(2) State Fishing Areas 6B and 7C, and

(3) Preserves previously established by the Director of Fisheries of the State of Washington for the protection of other species of food fish.

All times hereinbefore mentioned shall be Pacific Daylight Saving Time."

Emergency Orders

In order to provide for adequate racial escapement of Fraser River sockeye and pink salmon and for an equitable share of the season's catch by fishermen of the United States and Canada, the approved regulations as detailed above were later adjusted by the Commission as follows:

June 27, 1977—The Commission announced an emergency order that the regulations as approved by the Commission on June 1, 1977 for the 1977 season for sockeye and pink salmon fishing in United States Convention Waters apply to all citizens without exception. The Commission delayed the scheduled opening 24 hours for the week commencing July 3 in United States Convention Waters to avoid a commercial fishery operation on Independence Day.

July 4, 1977—To provide additional harvest of Early Stuart sockeye, the Commission approved an additional 24 hours fishing in Areas 17, 18 and District No. 1 of Canadian Convention Waters, making a total of two days fishing for the current week.

July 8, 1977—In order to secure escapement of Early Stuart sockeye, the Commission approved not opening any of the Convention Waters easterly of the Bonilla-Tatoosh Line to net fishing at the scheduled times for the week commencing July 10. District No. 1 and those waters of Areas 17 and 18 easterly of a line from Thrasher Rock Light to Salamanca Point to East Point and due south to the International Boundary of Canadian Convention Waters were also closed to commercial troll fishing.

July 12, 1977—In the interest of division of catch and to provide additional harvest of the Early Stuart run, the Commission approved the following regulatory changes:
1. That all United States Convention Waters open for one day of fishing on July 14.
2. That Areas 17, 18 and District No. 1 of Canadian Convention Waters open from 4:00 p.m. July 13 to 8:00 a.m. July 15.

July 15, 1977—In order to secure escapement of Early Stuart sockeye, the Commission approved not opening any Convention Waters easterly of the Bonilla-Tatoosh Line to net fishing at the scheduled times for the week commencing July 17. District No. 1 and those waters of Areas 17 and 18 easterly of a line from Thrasher Rock Light to Salamanca Point to East Point and due south to the International Boundary of Canadian Convention Waters would also be closed to commercial troll fishing commencing July 17.

July 18, 1977—In the interest of division of catch, the Commission approved fishing in Areas 17, 18 and District No. 1 of Canadian Convention Waters effective 4:00 p.m. July 20 to 8:00 a.m. July 22.

July 22, 1977—In the interest of division of catch, the Commission approved a reduction of 24 hours fishing in United States Convention Waters to one day of fishing for the week commencing July 24.

- July 29, 1977—The Commission approved the following regulation changes: 1. That Area 20 of Canadian Convention Waters open as scheduled for the week commencing July 31 but for only one day fishing. 2. That United States Convention Waters scheduled opening be advanced 24 hours for one day fishing. 3. That Areas 17, 18 and District No. 1 of Canadian Convention Waters open either July 31 or August 1, with an announcement to be made on July 31 for that week's fishing.
- July 31, 1977—In the interest of division of catch, the Commission approved 24 hours fishing in Areas 17, 18 and District No. 1 of Canadian Convention Waters effective 4:00 p.m. August 1.
- August 1, 1977—In the interest of division of catch, the Commission approved an additional 24 hours of fishing in Area 20 of Canadian Convention Waters making a total of two days for the week.
- August 4, 1977—To provide additional harvest of Quesnel River system runs, the Commission approved 24 hours additional fishing in Areas 17, 18 and District No. 1 of Canadian Convention Waters, effective 8:00 a.m. August 6.
- August 5, 1977—In the interest of obtaining additional harvest of the Horsefly River run, the Commission approved the following regulation changes: 1. That United States Convention Waters opening be advanced 24 hours for one day of fishing for the week commencing August 7. 2. That Area 20 of Canadian Convention Waters open 24 hours earlier than scheduled for two days fishing. 3. That Areas 17, 18 and District No. 1 of Canadian Convention Waters not open as scheduled on August 8.
- August 8, 1977—In the interest of obtaining additional harvest of the Horsefly River run, the Commission approved the following regulatory changes: 1. That fishing in Area 20 of Canadian Convention Waters be extended 24 hours, making a total of three days for the current week. 2. That United States Convention Waters open for one day fishing on August 9. 3. That District No. 1 of Canadian Convention Waters open for 24 hours at 8:00 a.m. August 10.
- August 19, 1977—In the interest of division of catch, the Commission approved a delay of 24 hours in the scheduled opening in Area 20 of Canadian Convention Waters, for one day fishing.
- August 23, 1977—In the interest of division of catch and the need for additional harvest of the pink salmon run, the Commission approved the following regulation changes: 1. That fishing in United States Convention Waters be extended 24 hours, making a total of three days fishing for the current week. 2. That fishing be extended one day in Area 20 of Canadian Convention Waters, making a total of two days for the week.
- August 26, 1977—In the interest of securing escapement of pink salmon into Georgia Strait and to allow harvest of sockeye in Canadian Convention Waters, the Commission approved the following regulations: 1. That United States Convention Waters and Area 20 of Canadian Convention Waters not open as scheduled for the week commencing August 28. 2. That District No. 1 of Canadian Convention Waters easterly of the Brunswick Cannery-Oak Street Bridge line open for fishing from 7:00 a.m. to 7:00 p.m. August 29.
- August 29, 1977—In the interest of division of catch and to provide additional harvest of pink salmon stocks, the Commission approved the following regulatory changes: 1. That United States Convention Waters open August 29 for two days fishing. 2. That fishing in Area 20 of Canadian Convention Waters open for two days fishing commencing August 31. 3. That District No. 1 of Canadian Convention Waters west of the Apex Line open for 24 hours fishing at 8:00 a.m. August 31. 4. That the waters of Areas 17 and 18 of Canadian Convention Waters, except in the scheduled closed portions, open for 24 hours at 8:00 a.m. August 31.
- August 30, 1977—Due to the oil spill in the Fraser River, the Commission approved the following regulatory changes: 1. That the opening on August 31 in District No. 1 of Canadian Convention Waters be cancelled. 2. That United States Convention Waters westerly of the Lily Point line be closed effective 9:00 p.m. August 30.

September 2, 1977—In the interest of the harvest of the pink salmon run, the Commission approved the following regulation changes: 1. That United States Convention Waters open as scheduled but for one day only. 2. That the scheduled opening in a portion of Areas 17 and 18 of Canadian Convention Waters be delayed 24 hours to 8:00 a.m. September 6. 3. That the waters in District No. 1 of Canadian Convention Waters easterly of the Brunswick Cannery-Oak Street Bridge line open for 12 hours fishing at 8:00 a.m. September 6 and that the waters westerly of the Apex Line open 8:00 a.m. September 6 for 24 hours fishing.

September 7, 1977—In the interest of division of catch, the Commission approved an additional 24 hours fishing westerly of the Apex Line in District No. 1 of Canadian Convention Waters starting 8:00 a.m. September 8.

September 9, 1977—In the interest of division of catch and because of the declining numbers of pink salmon in Juan de Fuca Strait, the Commission approved the following regulatory changes: 1. That control of Area 20 of Canadian Convention Waters and Areas 4B, 5 and 6C of United States Convention Waters be relinquished effective 12:01 a.m. September 11, one week earlier than scheduled. 2. That Areas 6, 6A, 7 and 7A of United States Convention Waters be closed until further notice.

September 13, 1977—In the interest of division of pink salmon catch and harvest of sockeye, the Commission approved an additional 24 hours fishing westerly of the Apex Line in District No. 1 of Canadian Convention Waters, effective 8:00 a.m. September 14.

September 15, 1977—In the interest of division of pink salmon catch and harvest of Weaver Creek sockeye, the Commission approved the following regulation changes: 1. That Areas 6, 6A, 7 and 7A of United States Convention Waters open for one day of fishing on September 16, with the waters westerly of the Lily Point line closed. 2. That United States Convention Waters and Canadian Convention Waters still under Commission control not open as scheduled for the week commencing September 18.

September 19, 1977—In the interest of division of catch and the declining numbers of pink salmon in United States Convention Waters, the Commission approved the following regulatory changes: 1. That District No. 1 of Canadian Convention Waters westerly of the Apex Line open for 24 hours, effective 8:00 a.m. September 21. 2. That control of Areas 6, 6A, 7 and that portion of 7A easterly of the Lily Point line of United States Convention Waters be relinquished effective 12:01 a.m. September 20. 3. That the waters westerly of the Lily Point line in United States Convention Waters remain closed.

October 3, 1977—In the interest of additional harvest of Weaver Creek sockeye, the Commission approved fishing from 8:00 a.m. to 7:00 p.m. October 5 in District No. 1 of Canadian Convention Waters lying easterly of the Brunswick Cannery-Oak Street Bridge line.

October 7, 1977—Due to the declining abundance of sockeye and pink salmon, the Commission relinquished regulatory control of the remaining Convention Waters still in the Commission's control effective October 9 as scheduled, thus completing the Commission's regulatory obligations for Convention Waters for the 1977 season.

SOCKEYE SALMON REPORT

The Fishery

The total 1977 Fraser River sockeye run was estimated at 5,781,000 compared with a preseason forecast of 7,000,000. The number of Fraser sockeye entering Convention Waters was 5,018,000 of which 3,658,000 (72.9%) were caught commercially, 246,528 (4.9%) were taken by the Indian food fishery, and 1,113,453 (22.2%) were recorded on the spawning grounds (see Tables I to VI in Appendix). An estimated 103,000 non-Fraser sockeye, mainly from the run to

Cedar River in Washington State, were also caught in Convention Waters. The estimated catches of Fraser River sockeye in non-Convention Waters in Johnstone Strait and northern Strait of Georgia and coastal waters north of Convention Waters, were 728,000 and 35,000 respectively. The non-Convention Waters catch of Fraser sockeye migrating through Johnstone Strait was 12.6% of the total run, compared with 4.8% in 1973, the preceding cycle year. The total commercial catch of Fraser River sockeye in non-Convention Waters fisheries in 1977 was 13.2% of the total Fraser sockeye run, compared with 5.9% in 1973.

The total 1977 Convention Waters catch of 3,760,762 was 1,445,789 smaller than in the brood year and the total Fraser sockeye run was 1,097,000 smaller. In the Convention area, Canadian fishermen caught 1,971,153 (52.41%) and United States fishermen caught 1,789,609 (47.59%) (Appendix Tables I and II).

In Canadian Convention Waters, 657,725 (33.4%) sockeye were taken in the waters westerly of William Head while 1,313,428 (66.6%) sockeye were caught easterly of William Head mainly near or in the Fraser River. The total catch and percentage made in the western area was the lowest on the cycle since 1965 when 173,860 (16.7%) sockeye were taken. The percentage and catch by purse seines (22.74%, 448,214) was considerably below the brood year (43.67%, 1,126,314) but only slightly below the average of cycle years 1961-1973 (24.56%, 476,325). The total gill net catch of 1,487,900 was the largest on the cycle since 1941 and the catch of 1,295,440 in District 1 was the largest for any year since 1958.

In United States Convention Waters, the purse seine catch (822,995) was the smallest on the cycle since 1965 and percentage (45.99%) was the lowest ever. The percentage caught by gill nets (50.28%) was the largest recorded for this gear although total catch in 1977 (899,757) was below the brood year catch of 1,075,698 fish. Reef nets caught 65,984 sockeye in 1977, the lowest catch on the cycle since 1965 and the percentage (3.67%) was the lowest ever on the cycle.

Fishing effort in United States Convention Waters showed a significant increase compared to previous cycle years (Table 4).

Table 4. United States Convention Waters maximum daily gear deliveries near peak of run.

<i>Year</i>	<i>Purse Seines</i>	<i>Gill Nets</i>	<i>Reef Nets</i>	<i>Total</i>
1965	153	432	55	640
1969	183	519	44	746
1973	151	725	48	924
1977	212	1,021	53	1,286

The increased numbers of fishing gear in 1977 associated with smaller run size and additional fishing days granted by the United States Government outside

Commission regulations, resulted in only 11 days fishing under Commission regulations during the period June 27-August 16 compared with 22 days fishing in 1973 from June 25-August 15.

In Canadian Convention Waters, there was a reduction in the total amount of fishing effort operating near the peak of the run compared to previous cycle years (Table 5).

Table 5. Canadian Convention Waters maximum daily gear deliveries near peak of run.

<i>Year</i>	<i>Purse Seines</i>	<i>Gill Nets</i>	<i>Total</i>
1965	67	1,211	1,278
1969	89	1,082	1,171
1973	129	1,178	1,307
1977	110	980	1,090

The total catch of sockeye by Indians in United States Convention Waters under United States Government regulations was approximately 196,000. In total, Indians had 31 fishing periods in State Areas 7 and 7A and 39 fishing periods in State Area 4B. The all-citizen fishery had 18 fishing periods. The total Indian catch made outside Commission regulations was about 11% of the total United States season's catch.

The major portion of the return in 1977 was composed of Early Stuart, Horsefly and Late Stuart sockeye. In the brood year (1973) these three races comprised 66.9% of the total return compared with an estimated 71.1% in 1977. The Early Stuart run in 1977, estimated at 1,333,000, was about the same size as in 1973 (1,367,000). These returns were possibly the largest ever to the system. The 1977 Horsefly-Mitchell River runs were the largest since 1917, totaling an estimated 2,167,000 sockeye compared with 1,627,000 in the brood year. For unknown reasons, the 1977 Late Stuart run return was only an estimated 608,000 fish compared with a return of 1,607,000 in 1973. Total effective female spawners for the respective brood years was almost identical (116,702 and 114,300). The decline in the Late Stuart race had a major impact on total sockeye catch in Convention Waters. Within the Late Stuart spawning areas, it appears that production from the Tachie River and Kuskwa Creek populations was disproportionately low in 1977.

Rates of production for different races were quite variable in 1977. Early Stuart, Horsefly and Scotch Creek runs had high rates of return, whereas Late Stuart, Chilko, Stellako, Raft and Birkenhead River runs had low rates of return.

The average weight of 4-year-old sockeye was 6.09 pounds, above the long term cycle average of 5.65 pounds. The increased production of the large Weaver Creek sockeye resulting from the spawning channel was again evident. The long term (1917-1977) cycle average weight of 4-year-old sockeye from August 4-

September 1 when Weaver Creek sockeye are present, has been 5.75 pounds. In 1977 during this time period, the average weight was 6.49 pounds, the highest of any year on the cycle.

Escapement

The net escapement of 1,113,453 sockeye represented 22.2% of the 1977 Fraser run to Convention Waters and 19.3% of the calculated total Fraser River run. The total escapement was slightly below the brood year level and was characterized by excellent escapements into some systems but less than desirable numbers of spawners in other areas.

The escapement of 118,017 Early Stuart sockeye was disappointing when compared to the total of 300,653 recorded in 1973. Although the number of days of fishing authorized by the Commission in 1977 was greatly reduced compared to 1973 (18 and 10 respectively), and run size was about equal for the two years, the total escapement arriving at the spawning grounds was reduced to just slightly better than the 1969 level. The escapement objective was 400,000 Early Stuart sockeye past the commercial fishing boundary at Mission. Echo sounding and test fishing in the Fraser River indicated that about 300,000 Early Stuart sockeye escaped past Mission. The estimated 102,000 Early Stuart sockeye taken on extra days of fishing authorized by the United States, would have been additive to the gross escapement to the Fraser River. The substantial unreported catches of sockeye in the lower Fraser commercial area also are believed to have been made largely from the Early Stuart run. The end result of excessive fishing was that the escapement was only a little more than one-third as large as in the brood year. All of the individual spawning creeks had escapements below the brood year level.

The Bowron River escapement of 2,500 was just slightly more than half as large as in 1973. The Early Nadina race continued to decline to the lowest level on the cycle since 1945. Even though the spawning channel was available for the Late Nadina run starting in 1973, the total escapement of 16,896 was only 159 larger than in the brood year. The Stellako escapement was down 7,303 fish from the brood year level and was the lowest number on the cycle since 1945. The Stellako and Early Nadina escapements were down by 23.8% and 46.3% compared with the brood year, whereas the spawning channel-assisted Late Nadina run showed a slight increase in escapement.

The escapements to Upper Pitt River, Seymour River and Scotch Creek were larger than the brood year escapements, with the latter two races more than twice as large as in 1973. The Scotch Creek escapement of 13,586 was the largest yet recorded. The Gates Creek run also showed significant improvement and was more than three times larger than in 1973, and the largest on record for the cycle. Other races migrating at the same time, such as Raft River and Chilko sockeye, had escapements below the brood year level. The decrease at Chilko was not significant but the Raft run continued to show a precipitous decline on this cycle, reaching the lowest number since 1941.

The most dramatic increase in escapement occurred at Horsefly and Mitchell Rivers where 515,000 returned, compared with 278,000 in 1973. This was the largest escapement since 1913. A most significant aspect of the Horsefly escapement was the spawning of about 75,000 sockeye in the lower areas of the river near Horsefly, where early reports indicate large numbers of sockeye spawned.

While the Horsefly escapement increased by 237,000 in 1977 compared to 1973, the Late Stuart population migrating at the same time declined by 68,000 fish from 214,343 in 1973 to 146,629 in 1977. The 1977 escapement was the lowest on the cycle since 1945. The most noticeable decrease occurred at Kuskwa Creek and Tachie River where escapement levels were down 55.1% and 44.3% respectively from brood year levels. The Middle River population (80,420) was down 11,459 fish, or only a 12.5% reduction. If a large Horsefly escapement had not been obtained, the Late Stuart population would have been even smaller.

The Birkenhead River escapement declined significantly from 139,295 in 1973 to only 43,139 in 1977, and was the lowest on the cycle since 1965.

Late run escapements to Harrison River and Cultus Lake were below those recorded in 1973. The escapement of 55,145 sockeye to Weaver Creek increased by about 5,000 compared to 1973. The 33,040 sockeye spawning in the channel was the largest number to date. However, a disastrous flood early in November will greatly reduce fry production in the spring of 1978 from both the creek and channel. For several hours a log jam on the highway bridge forced the flow of Weaver Creek over the dyke protecting the channel, causing severe silting of the gravel bed.

The escapements to Portage Creek, Lower Shuswap River and Adams River were all considerably larger than in 1973. The Lower Shuswap River escapement has increased from only 583 in 1965 to 14,695 in 1977, the largest escapement on record for this cycle. The Portage Creek escapement of almost 8,000 was the largest on record for the cycle.

Success of spawning was good in all areas except at Horsefly River (61.8%), Mitchell River (63.8%), Gates Creek (75.1%) and Chilko River (68.7%). For the entire escapement to all areas, success of spawning was 73.5%. The continued problem in the Quesnel area was discouraging, but total egg deposition there was the largest since 1913.

Echo sounders were used again to estimate the daily sockeye escapements at two sites in the lower Fraser River. The data from the two sites and from test fishing did not agree during portions of the sockeye migration. Although the total adult sockeye escapement estimate was only 7% lower than the spawning ground and Indian fishery catch total, major discrepancies existed in the estimation of the escapement of individual stocks. Racial analysis was implicated, as were estimation procedures in the echo sounding program.

The Indian subsistence catch of 246,528 was the largest on record for the cycle and was about 84,000 larger than in 1973. The Commission is becoming increasingly concerned about the continued growth in the catch of the Indian food fishery along the Fraser River. In addition to the reported catches, there are unreported catches by illegal fishing for which no estimate can be made. It is common knowledge that substantial quantities of these salmon are sold to the public. The Commission has to take these circumstances into consideration in managing the commercial fisheries and setting escapement goals past the commercial fishing boundary at Mission. Substantial reduction in fishing time has occurred in the commercial net fishing areas in both countries during the past twenty years. The number of Indian fishing permits has doubled in the last twenty years but corresponding reduction in fishing time has not taken place in the Fraser River Indian food fishery.

PINK SALMON REPORT

The Fishery

The total 1977 Fraser River pink salmon run was estimated at 8,173,000, about 3,773,000 larger than the predicted 4,400,000 return. The run was 2,173,000 larger than the average run size of 6,000,000 recorded from 1959 through 1975.

The marine survival of fry produced by the 1975 brood spawning was 2.9% (Table 6), or the same as the average survival rate of 2.9% recorded for the previous seven brood years (1961-1973). The total number of pink salmon in 1977 was above the average return due to the large number of fry which migrated to sea in the spring of 1976 (279,000,000). This was the third largest fry migration since 1962.

Table 6. Fraser River pink salmon production. (Fry production data not available prior to 1961.)

	<i>Brood Year</i>									
	1957	1959	1961	1963	1965	1967	1969	1971	1973	1975
Total Spawners (millions)	2.425	1.078	1.094	1.953	1.191	1.831	1.529	1.804	1.754	1.367
Female Spawners (millions)	1.423	.596	.654	1.217	.692	1.015	.961	1.103	1.015	.806
Potential Egg Deposition (billions)	2.8745	1.0847	1.5692	2.4348	1.4878	2.1321	2.0182	1.923	1.865	1.493
Fry Production (millions)	—	—	143.6	284.2	274.0	237.6	195.6	245.0	292.4	279.2
Adult Return Catch + Escapement (millions)	6.459	1.890	5.326	2.271	12.850	3.849	9.707	6.753	4.867	8.173
Freshwater Survival	—	—	9.2%	11.7%	18.4%	11.1%	9.7%	12.7%	15.7%	18.7%
Marine Survival	—	—	3.7%	0.8%	4.7%	1.6%	5.0%	2.8%	1.7%	2.9%

The total number of pink salmon entering Convention Waters in 1977 was estimated to be 7,565,000 fish (Table 7) compared to 4,363,000 in the brood year. Fraser River pink salmon formed 80.2% of the total pink salmon run reaching Convention Waters, compared to 83.7% in 1975. The harvest of 484,231 United States pink salmon in Convention Waters constituted 35.4% of the United States run to Convention Waters, whereas 60.2% of the Fraser run to Convention Waters was harvested in the commercial fisheries. Closures in certain areas of Convention Waters and reduced number of days fishing were regulatory methods employed in response to a request by the State of Washington to afford maximum protection to their various stocks of pink salmon migrating through Convention Waters. The preseason prediction by the State was for a total return well below escapement requirements.

Table 7. Calculated catches and percentage harvest from pink salmon runs entering Convention Waters in 1977.

	<i>Source of Run</i>			<i>Total</i>
	<i>United States</i>	<i>Fraser River</i>	<i>Canada Non-Fraser</i>	
Total Entering Convention Area	1,369,423	6,065,688	130,304	7,565,415
Catch in Canadian Convention Waters				
Westerly of William Head	421,144	1,313,949	39,476	1,774,569
Easterly of William Head	—	296,518	4,391	300,909
Total	421,144	1,610,467	43,867	2,075,478
Percent Harvest	30.75	26.55		
Catch in United States Convention Waters	63,087	2,038,554	66,789	2,168,430
Percent Harvest	4.61	33.61		
Total Catch in Convention Area	484,231	3,649,021	110,656	4,243,908
Percent Harvest	35.36	60.16		

The 1977 catch in Convention Waters was 4,243,908 compared with 2,509,045 in 1975 (Appendix Table XI). The division of catch was Canada 2,075,478 pinks (48.90%), and the United States 2,168,430 (51.10%).

The outstanding feature of the fishery was the catch distribution by gear within the Canadian fishery. Troll fishermen caught 987,610 pink salmon in all Convention Waters, amounting to 47.59% of the total Canadian catch. The catch and percentage were the highest yet recorded, exceeding the 975,268 recorded in 1967 and 25.29% in 1969. Although the total catch made in 1977 by trollers was only 12,342 larger than in 1967, the timing of the catch and its proportion of the total run was distinctive.

The catch in 1977 by trollers was made early in the season compared with 1967. As of August 1, 1967, only 11.7% of the season's total troll catch in Convention Waters had been landed, whereas in 1977 by the same date 34.2% of the season's total catch had been taken. Trollers in 1967 had taken 53.0% of the total catch by all gear by August 15, whereas in 1977 the troll catch to the same date formed 67.9% of the total catch. The large early season troll catch created a serious early season division problem before the run reached United States Convention Waters. On August 21 the Canadian total catch of pink salmon was estimated at 1,207,000, and for the United States only 284,000. A division difference of this magnitude had never before been encountered, and the season's total predicted catch by Canada had been exceeded before run size had been determined and before net fishermen had an opportunity to fish.

The estimated total West Coast catch by trollers of Fraser pinks by fishermen of both countries in all areas in 1967 formed 14.0% of the total Fraser run, and in 1977 the catch by trollers increased to about 21.4% of the Fraser run.

The percentage of the total catch made by purse seines declined from 50.88% in 1975 to only 38.89% in 1977. The percentage taken in 1977 was the lowest since 1969, when only 32.23% was taken by seiners. Gill nets in 1977 took only 13.52% of the total catch, down from the 29.98% taken in 1975, and the percentage for 1977 was the lowest on record.

Catch distribution of pink salmon in Canadian Convention Waters showed that about one-half (47.3%) of the total catch was made before the fish reached the net fishing area. In 1969, which was the previous high year, 24.8% of the catch was made in the outside fishery. The long term average removed by the troll fishery from 1957-1975 was 16.0%. The unprecedented high percentage recorded in 1977 emphasizes the effect of the troll fishery on the catch in the net fishing area. The percentage of the Convention Waters catch taken in Area 20 (38.2%) was the lowest since 1947 when the fishing capabilities of the area were just being developed. From 1957 to 1975 the Area 20 fishery had taken, on the average, 61.3% of the season's annual catch. The District 1 catch of only 262,196 pinks was the lowest since 1969 and percentage (12.6%) the lowest since 1963.

In United States Convention Waters, purse seines caught 82.49% of the total catch, the highest percentage since 1967 when 83.71% were taken. Gill nets caught 9.15%, the lowest since 1969. The reef net catch of only 30,069 was the lowest catch since 1965 and percentage (1.40%) was the lowest since 1935, the first year of records. The troll catch of 163,416 was the best since 1967 and the percentage of 7.54% was the largest since 1965.

Escapement

The total 1977 escapement of pink salmon to the Fraser River was 2,387,811 fish (Appendix Table XIV), or about 29.2% of the total run. Of the total run reaching Convention Waters (6,066,000), 39.4% arrived at the spawning grounds. The total escapement in 1977 was over one million larger than in the brood year and was the largest since 1957.

The total Early run escapement of 2,195,769 was the largest thus far under Commission management. It exceeded the previous maximum recorded in 1957 by about 584,000 fish. Not only was the increase in numbers of spawners encouraging, the distribution of the escapement was also favorable. The total escapement above Hell's Gate of 1,417,000 was the best on record, approximately 650,000 higher than in 1975 and most likely the largest since 1913. The Thompson River escapement of 972,941 was more than double the 1975 total of 480,350 which had been the largest on record since 1945 when the Hell's Gate fishways were completed. There still was room for many more spawners based on field observations. Pink salmon were observed spawning in the North and South Thompson Rivers, Little River, Adams River and even in the Lower Shuswap River. Early historical records indicate similar widespread distribution of pink salmon. The Seton Creek escapement of 389,541 fish was also the largest on record. Both spawning channels were filled to capacity with combined totals exceeding any year to date. The escapement of 19,904 pinks into Portage Creek in 1977 was almost 10,000 less than in 1975. A very significant improvement occurred in the numbers of fish utilizing the vast main Fraser River area. In 1975 there were only 315,049 spawners in this area, and in 1977 the total was 775,016. However, this number is still considerably below the 1,264,000 spawners in 1957.

The effect of the severe flooding in the fall of 1975 was evident in the Late run escapements. Despite reduced fishing effort on the Late runs, the total escapement of 183,796 Late run pinks was the poorest recorded since 1957. The Chilliwack-Vedder River escapement of only 48,561 fish was down 40.2% compared with 1975. This decline was expected because of the flood in that river in 1975. However, the 29.6% reduction in the Harrison River escapement was unexpected.

The total Late run escapement in 1977 constituted the lowest percentage (7.7%) of the total Fraser River's escapement since 1957. During the period 1957 through 1975, the Late run escapement averaged 25.2% of the total annual escapement. It is quite apparent that a much larger Fraser River pink salmon run would have resulted in 1977 had the Late run contributed a normal share of seaward migrating fry, since the brood year percentage of the total escapement, 20.4% (279,000 fish), was adequate to have added substantial numbers of pinks to the return.

The estimated rate of return per spawner for Early run pinks in 1977 was 6.71 while the Late run was only 2.28. If the Late run spawners in 1975 had experienced an equivalent rate of return compared with the Early run, an estimated additional 1,237,000 Late run pinks would have been produced. It is unfortunate that construction of the pink salmon spawning channel on the Chilliwack River was not approved by the Canadian Government, as this facility would have offset some of the adverse effects of the flood.

Spawning conditions in all areas were good in 1977 except for a flood at Weaver Creek and Chehalis River on November 1.

Field observations in 1977 and the analysis contained in the Commission's 1971 Annual Report indicate that, with proper distribution of spawners, much larger escapements than those recorded in 1957 and in 1977 would be desirable.

Echo sounders were also used for the first time to estimate the daily pink salmon escapements at two sites in the lower Fraser River. The pink salmon escapement estimate was about 20% low, apparently due to the same problems affecting the sockeye estimate. The lack of accuracy suggests that basic procedures in the echo sounding program require examination and improvement.

A reduction in fishing time in certain Convention Waters net fishing areas associated with extensive closures to fishing during specified time periods (West Beach), contributed in part to greatly increased escapements into a few Washington State streams (Appendix Table XV) in 1977 compared with 1975 levels.

SPAWNING CHANNEL OPERATIONS

Fry production from the 1976 spawning of sockeye at channels operated by the Commission is given in Table 8.

Table 8. Sockeye fry production at spawning and incubation channels from the 1976 brood year spawning.

<i>Site</i>	<i>Eggs Deposited</i>	<i>Fry Produced</i>	<i>Percent Survival</i>
Upper Pitt	4,648,000	3,861,000	83.1
Weaver Creek	65,059,000	52,753,000	81.0
Gates Creek	26,177,000*	17,533,000**	67.0
Nadina River	2,413,000	1,593,000	66.0

* Includes 318,000 eggs planted from moribund females.

** Includes 251,400 fry from the planted eggs.

At the Nadina River channel an additional 4,127,000 eggs were transferred from the Stellako River and planted green in the upper portion of the channel in an area from which the small population of spawners had been excluded. These eggs produced 717,000 fry, which is a survival of only 17.4%. The poor survival of this plant is believed to have been the result of planting procedure. The number of fry from the Weaver channel is over three times more than from the previous cycle and is the largest number produced on any year to date. The density of spawners in the channel in 1976 (0.9 females per sq yd) was the highest of any year, and there is no indication of any density effect on fry output up to this density. Fry production from the Gates Creek channel was nearly three times more than for the previous cycle and was the largest of any year.

The total Pitt River run in 1977 was estimated at 75,783 sockeye, of which 32,871 were produced by the channel (Figure 1). The small run is partly attributable to the low fry production in 1973, the brood year for the four year old fish. The total Weaver Creek adult run in 1977 was estimated at 334,642 sockeye, of

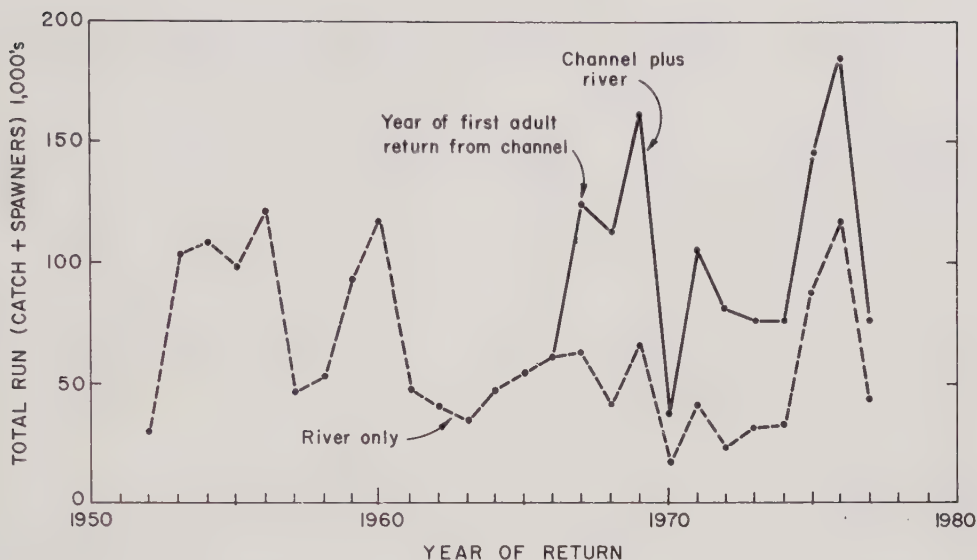


FIGURE 1—Sockeye production from Pitt River and Pitt River incubation channel.

which 301,817 were produced by the channel (Figures 2, 3). The percentage survival from eggs to adults for both the creek and channel was next to the lowest since 1965. Despite this, this was the second largest return from the channel, the highest being in the brood year 1973. The total Gates Creek run in 1977 was estimated at 11,184, of which 10,748 were produced by the channel. This run was nearly three times larger than in the brood year and is a significant gain for this off year. The first returns from the Nadina River channel were obtained in 1977 from the brood year spawning in 1973. The Late Nadina adult run was estimated at 79,101 sockeye, of which 77.6% or 61,382 were produced by the channel. This was the dominant cycle for Late Nadina, and the run was the smallest on the cycle since start of records in 1953.

The 1977 egg take of 4,909,000 for the Pitt River incubation channel was the largest yet obtained. At Weaver Creek, the number of sockeye spawners was increased to 33,040, the largest number yet obtained and 1.5 times more than in the brood year. This increase was made to obtain a higher density of spawners than in previous years to provide further information on the effect of density of spawners on fry output. However, a flash flood on November 1 resulted in a large log jam on the public road bridge adjacent to the channel, which raised the creek level, causing a large flow of muddy water and debris across most of the spawning channel site. Spawning was almost finished at the time and there was little, if any, loss of eggs from the channel. However, substantial amounts of silt were deposited in the channel and it is anticipated the survival rate of the eggs will be substantially below normal for the channel.

At Gates Creek channel, the number of spawners increased from 668 in 1973 to 1713 in 1977. The escapement of 2889 sockeye to the Gates Creek system was the largest yet recorded on this cycle, and reflects the combined effects of

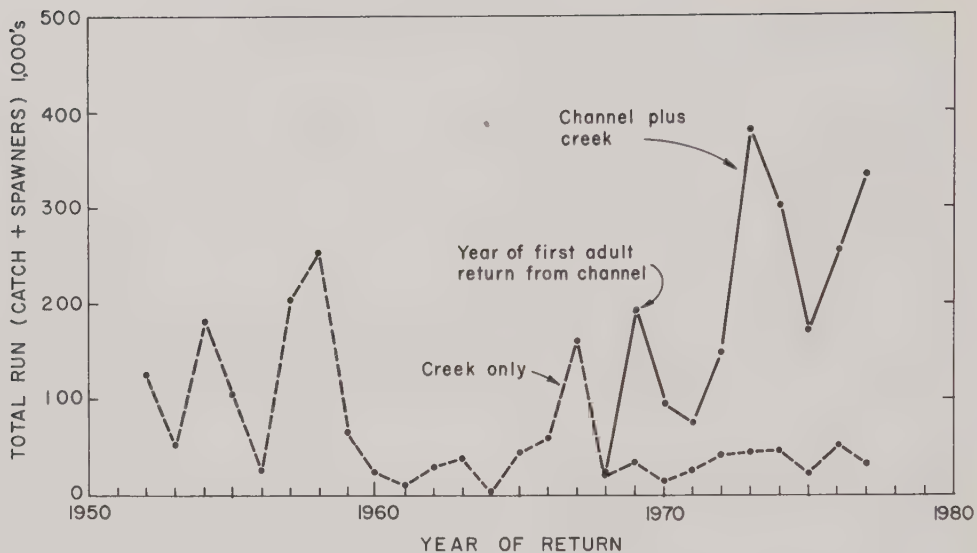


FIGURE 2—Sockeye production from Weaver Creek and Weaver Creek channel.

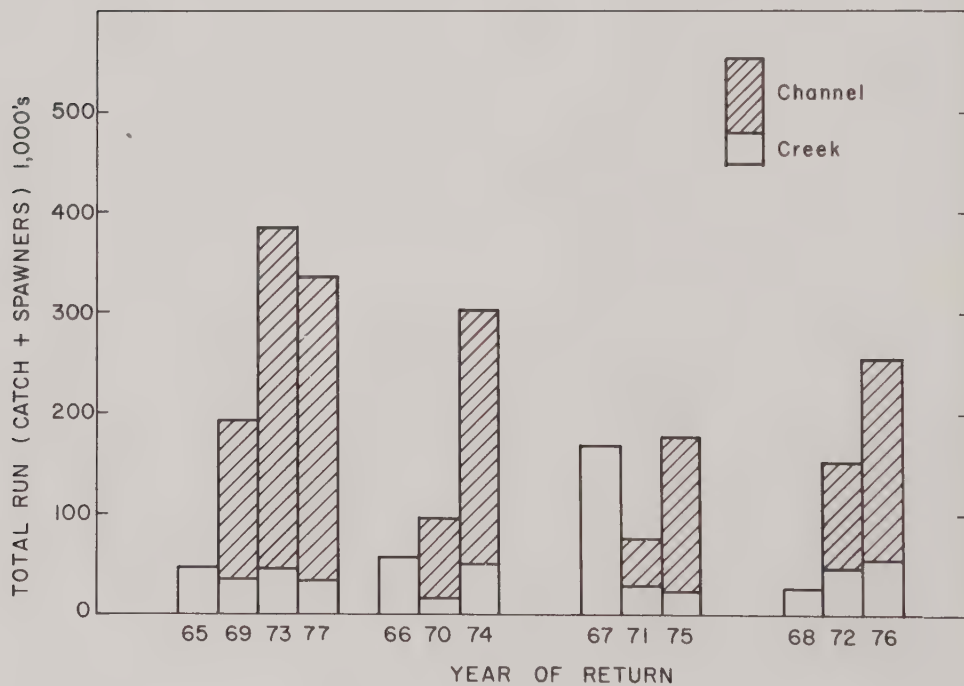


FIGURE 3—Number of adult sockeye produced from spawning in Weaver Creek spawning channel compared to the number produced by natural spawning in the creek, by cycle years.

improved production attributable to the channel and improved passage of the run at the Seton Creek powerhouse tailrace in 1977.

At the Nadina River channel, the number of spawners increased from 8786 in 1973 to 16,286 in 1977. Much of the increased escapement was obtained from the river population which decreased from 7951 in 1973 to 610 in 1977. The fish selected the spawning channel in 1977, whereas in 1973 considerable effort was needed to put fish into the channel.

A detailed report (Progress Report 36) on the channels and the benefits they have produced to fishermen was published during 1977.

REHABILITATION

As mentioned in previous Annual Reports, the scope of work in rehabilitation has been curtailed because of lack of agreement between the two countries in funding the Commission's development program recommended in 1972.

The 1975 transplant of Seymour River sockeye eggs to the Upper Adams River, in distinct contrast to the 1974 transplant, apparently did not result in any sockeye migration from Adams Lake in 1977. Only one smolt was observed during the normal spring period for such immigration. No jacks were seen at Upper Adams River in the fall of 1977 as forerunners of the anticipated return from the 1974 transplant. The return of four year old adults in 1978 now must be awaited as the final measure of success of this transplant, which was a follow-up of earlier attempts to replace the extinct Upper Adams sockeye run.

RESEARCH

Research into the lacustrine biology of sockeye was conducted in the lakes throughout the Fraser system with emphasis on Cultus and Shuswap Lakes. Sockeye abundance, distribution, growth and plankton standing crop, species composition and other limnological parameters such as water temperature, clarity and conductivity were examined.

The 1977 plankton standing crop in all the major sockeye rearing lakes remained at a level considered stable for this cycle. Four lakes, Chilko, Fraser, Harrison and Pitt, had sockeye escapements of considerable size in 1976. The increase in the 1977 standing crop at Chilko and the decrease at Harrison compared to 1973 data was consistent with the relative size of the 1976 spawning population (Table 9).

Both Fraser and Pitt Lakes indicate an increase in the 1977 standing crop when compared with 1973, and yet both had an increase in the number of effective spawners. These data indicate a general increase in zooplankton production over the levels of 1973.

Table 9. Mean standing crop and number of effective female spawners as an index to number of fry present in residence year.

Lake	Mean Standing Crop (c.c.)		No. Effective Female Spawners	
	1973	1977	1972	1976
Fraser	2.05	2.65	19,900	63,900
Chilko	0.49	0.54	333,300	211,600
Harrison	0.33	0.21	41,200	78,300
Pitt	0.12	0.15	5,400	18,200

The standing crop of plankton in Shuswap for 1977 was approximately 3 times that of 1973 and second only in the cycle to the level recorded for 1961 (Figure 4). The data suggest an overall periodicity of zooplankton abundance, with superimposed annual variations as a result of cropping by sockeye.

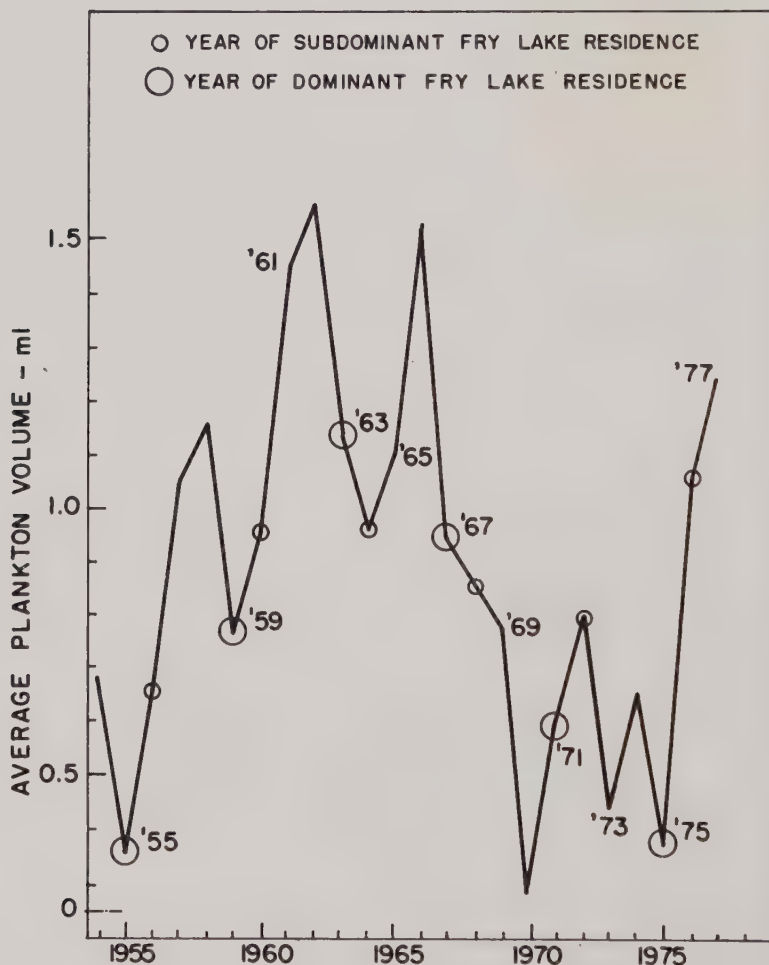


FIGURE 4—Average plankton volumes at Sorrento, Shuswap Lake, showing years of lake residence of fry.

An examination of species composition of plankton at Shuswap indicates that with large sockeye populations, the percentage of cladocerans in the zooplankton population is decreased (Table 10). The very low plankton standing crop in 1971 (Figure 4) would have presented a less than favourable food situation for sockeye and may have contributed to the relatively small size (3.50 gm) of the Shuswap smolts in 1972. The standing crops of zooplankton have recovered from the low levels from 1968-1975, and the major spawning populations in 1970 and 1974 did not have lasting effects on the zooplankton levels in Shuswap Lake.

Table 10. Average percentage of cladocerans and copepods present at Sicamous and Sorrento stations of Shuswap Lake.

Date	Percent Cladocerans		Percent Copepods	
	Sorrento	Sicamous	Sorrento	Sicamous
1971*	4.62	7.50	95.38	92.50
1974	20.99	22.11	79.01	77.89
1975*	10.22	17.22	89.78	82.78
1976	17.23	22.08	82.77	77.92

* Year of dominant cycle residence.

The sockeye feeding behaviour study started in 1976 at Cultus Lake continued in 1977. Acoustic surveys located sockeye during feeding, and trawl and plankton samples were collected simultaneously. A comparison was then made with the plankton sample and the gut content of the sockeye. The fry appeared to be selecting the cladocerans *Daphnia* and *Bosmina* and at times *Leptodora*. Calanoids and cyclopoids were taken in small amounts or not at all during these sample times (Table 11). The fry also appeared to select for adult organisms over immature forms (Table 12).

Table 11. Comparison of relative abundance in plankton sample with relative abundance in gut of sockeye fry from Cultus Lake.

Date and Depth		Percent Composition of Genera Present				
		<i>Daphnia</i>	<i>Bosmina</i>	<i>Leptodora</i>	<i>Calanoid</i>	<i>Cyclopoid</i>
June 6 (17 m)	Gut content	44.09	47.31	0	8.60	0
	Plankton sample	11.33	6.41	0	3.57	88.69
July 6 (18 m)	Gut content	73.56	20.31	1.53	4.60	0
	Plankton sample	22.27	37.81	0.10	10.98	28.84
July 6 (22 m)	Gut content	61.96	28.84	3.68	5.52	0
	Plankton sample	2.23	7.37	0.06	6.70	83.64
October 6 (35 m)	Gut content	90.89	5.51	1.08	1.08	1.44
	Plankton sample	7.08	6.12	0.25	0.60	85.95

Table 12. Comparison of relative abundance in plankton sample of adult organisms with relative abundance in gut of sockeye fry from Cultus Lake.

	June 6 (17 m)		July 6 (18 m)		July 6 (22 m)		Oct. 6 (35 m)	
	% <i>Adult</i>	% <i>Immature</i>	% <i>Adult</i>	% <i>Immature</i>	% <i>Adult</i>	% <i>Immature</i>	% <i>Adult</i>	% <i>Immature</i>
Plankton Sample	0.29	99.71	4.55	95.45	6.57	93.43	2.88	97.12
Gut Content	31.18	68.82	40.23	59.77	36.20	63.80	51.20	48.80

Acoustic surveys were made of thirteen sockeye rearing lakes in the Fraser system, with only Chilko and Lillooet Lakes not surveyed. Population estimates were made for each lake, but further analysis is required to separate the kokanee. The method used had limitations where high densities of fish occurred, such as in Harrison, Pitt and Cultus Lakes. This limitation will be overcome by improved equipment for data collection and analysis.

Prespawning mortality had a major impact on the dominant Horsefly run with a loss of 40.3% of the female sockeye prior to spawning (Table 13). In spite of this, the number of effective female spawners was increased substantially over the brood year, and was the largest since 1913.

Table 13. Comparison of Horsefly-McKinley female sockeye population, 1969, 1973 and 1977.

<i>Date</i>	<i>Female Population</i>	<i>Percent Mortality</i>	<i>Effective Females</i>
1969	158,333	52.0	75,964
1973	139,579	27.5	101,231
1977	246,989	40.3	147,378

A study on the possible causes of the mortalities was carried out by the Fish Health group of the Pacific Biological Station in cooperation with Commission staff. There was no obvious difference in the microbiology of the fish examined compared to previous cycles. There was, however, an extremely heavy sporozoan parasitic infection in the kidney of the moribund fish which was not detected in previous cycles, and the virus IHN was found in a low percentage of samples examined.

Studies of possible methods of alleviating some of the impact of this mortality have been continued. Previous tests have shown that eggs from moribund females could be successfully fertilized. In 1976 approximately 300,000 eggs from moribund Gates Creek females were fertilized and planted in an isolated part of the channel. This group of eggs had an egg to fry survival of 80%. Fry from this

group were raised over summer in 1977 at the Sweltzer Creek Research Station and no differences in quality could be detected when they were compared to control fish. Therefore, in 1977 approximately 6,400,000 eggs were stripped from moribund Horsefly females. These eggs were fertilized and planted in a previously prepared gravel bed in McKinley Creek at the outlet of McKinley Lake. The gravel in this section is similar to that used in spawning channels. The fry will be enumerated in the spring of 1978.

Four years ago it was reported that the virus Infectious Haematopoietic Necrosis, or IHN, had been isolated from 1972 brood Chilko fry. This was the first known case of IHN in wild fish. In the spring of 1973 the numbers of fry entering Chilko Lake were substantially lower than expected (Figure 5). The 630 million eggs deposited in 1976 should have produced in the vicinity of 45-50 million fry, but enumeration this spring indicates only 15.6 million fry migrated into Chilko Lake. Samples of fry were collected and shipped to Nanaimo Biological Station for processing. All of the fry submitted had active IHN. Therefore it appears that IHN has once again had a serious impact on the Chilko fry production on this cycle. There has been no evidence of IHN in the other cycles since the observation for the 1972 brood stock. In the 1972-76 cycle, the Chilko run has accounted for more than 60% of the commercial harvest of Fraser sockeye. Unless some control of the virus can be found, the future of the Chilko run on this cycle is bleak. At present there is no known treatment or preventative measure suitable for use at the spawning grounds and there is urgent need for research to develop a suitable treatment.

The program to investigate the feasibility of producing an even year pink salmon brood stock of Fraser origin continued. The 2000 even year fry being raised at the Sweltzer Creek Research Laboratory grew well and mortality was small until October 1977. At that time a bacterial gill infection, perhaps complicated by dietary deficiencies, resulted in loss of all of these fish.

A second group of pinks taken from the 1975 brood Seton Creek population is presently being raised on a three-year cycle and should reach maturity in the fall of 1978. The zooplankton diet is being supplemented with vitamins and the fish are also receiving periodic prophylactic antibiotic injections to control kidney disease. The overall mortality has been lower in this group and the growth more rapid, which should produce larger and more adult pink salmon in 1978.

Investigations of methods of forecasting the magnitude of Fraser River sockeye and pink salmon runs were continued during 1977. As previously mentioned, the 1977 sockeye run was about 1.2 million fish fewer than predicted, and the pink run was nearly 3.6 million fish more than predicted. The discrepancies in the forecasts based on correlation of environmental factors with survival indicate the need for further analysis of the interrelationships and the need for better understanding of the links between the factors and specific aspects of the salmon's life cycle. It is unlikely that great precision in forecasting can be achieved, but accuracy sufficient for management and industry planning does appear to be practicable.

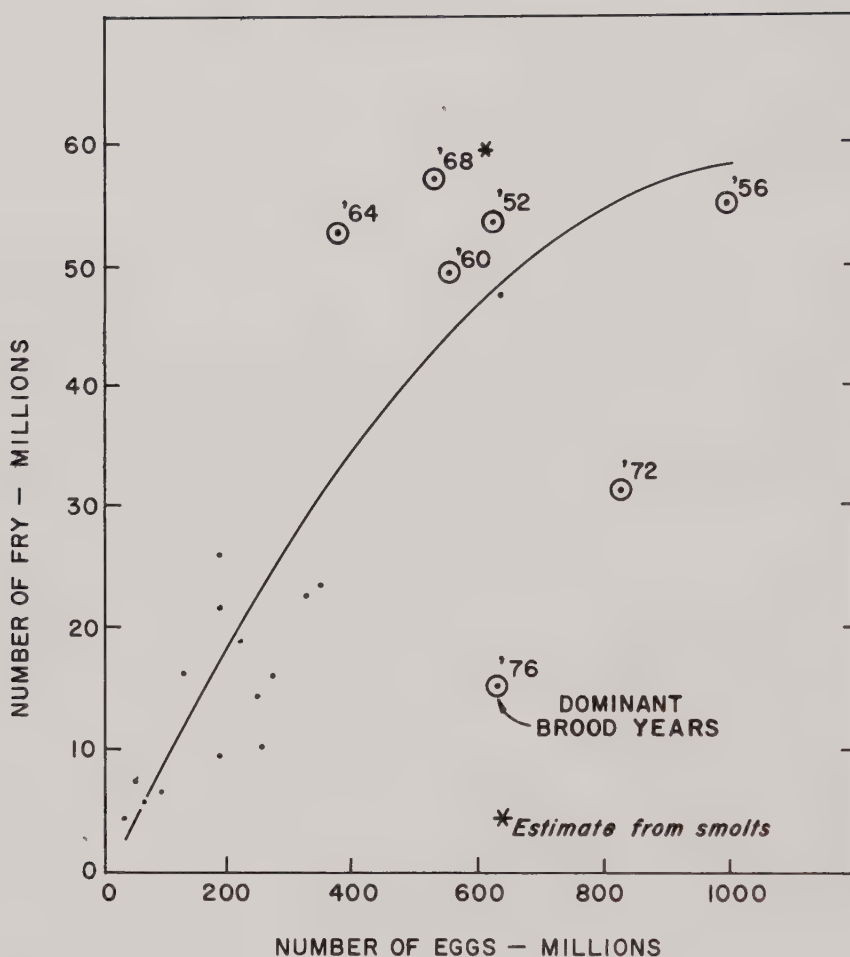


FIGURE 5—Chilko fry production compared to egg deposition.

ENVIRONMENT PROTECTION

Previous Annual Reports have referred to the upgrading of biological effluent treatment facilities at Prince George Pulp and Paper Company and Intercontinental Pulp Company at Prince George. These mills have now extended treatment time to four days or more. The effluents will undergo partial treatment at each mill before combining in an aerated lagoon for the final treatment phase. Effluent will be discharged to the Fraser River through a multiport diffuser used previously only by Prince George Pulp and Paper. Theoretical calculations indicated dilution of the combined effluent through the diffuser, even though modified, would be near the lower limit allowed by provincial objectives. Owing to the limitations of theoretical calculations in this instance, the Commission recommended on-site measurements of diffusion in 1978.

Although a treatment time of four days or more has been successful for kraft mill effluent, sufficient aeration capacity must be maintained when load to the treatment system increases. This was evident at Cariboo Pulp and Paper Limited at Quesnel where the pulp mill experienced a period of substandard treatment. Major refitting and modifications undertaken at the mill lessened load on the treatment system, but not enough to meet aeration capacity. Consequently an additional five aerators are to be installed in the aerated lagoon.

Improvements have been made in waste handling at the Scott Paper Co. Limited groundwood pulp mill and paper plant on the North Arm of the Fraser River in New Westminster, where a program to upgrade pollution control has been underway for the past few years. Recent extension of the municipal sewer system permitted discharge of wastewaters from the groundwood mill to the municipal sewer for treatment at Annacis Island sewage treatment plant. The remaining wastewater is treated on site before discharge to the Fraser River.

At the Belkin Paperboard Limited wastepaper recycling plant on the North Arm of the Fraser River below New Westminster, the current method of treatment has not been adequate to meet federal regulations or provincial objectives for the effluent. Alternative methods of handling the effluent are under investigation.

The Pollution Control Branch issued a discharge permit for Annacis Island sewage treatment plant in 1971, which specified primary treatment, authorized discharge of 129 million imperial gallons per day, set limits on a wide range of substances including toxic materials such as metals, cyanide and phenol, and specified a toxicity limitation equivalent to 1.33 toxic units. Studies by the Commission in cooperation with Environment Canada at four primary treatment plants in the Greater Vancouver area, including Annacis Island, indicated the effluents contained 2.5 to 5 toxic units in the absence of residual chlorine. These data suggest toxicity at the Annacis plant will have to be reduced severalfold to meet specifications in the permit. Based upon experience reported in the technical literature, these permit conditions can be met and substantially improved upon by secondary treatment.

The high toxicity to fish of residual chlorine and the formation of chlorinated organic substances during disinfection of sewage with chlorine has been discussed in previous Annual Reports. Commission investigations in 1975 have shown that the toxicity caused by residual chlorine can be removed by dechlorination before discharge to receiving waters. Dechlorination has been adopted at Annacis Island and Lulu Island sewage treatment plants on the lower Fraser River and adoption of this treatment has been recommended at other plants where chlorination is required.

During 1977, B. C. Hydro and Power Authority and its consultants continued examination of environmental aspects of the proposed Hat Creek thermal power plant. The conceptual design of the mine and generating plant proposed no aqueous discharge to receiving waters, but gaseous emissions would contain oxides of sulfur and nitrogen which may give rise to abnormally acid precipitation.

An ad hoc committee, with representation from the Commission, Environment Canada and other agencies, prepared a review of the acid precipitation phenomenon and its effect on terrestrial and aquatic ecosystems. The review concluded by recommending a monitoring program to include chemical measurements of precipitation and surface waters. The committee concluded from the technical literature that symptoms of acidification would be observed first in small, high altitude lakes. Therefore emphasis was placed on such lakes as important monitoring sites. However, large, moderate and small lakes at lower altitudes, including sockeye rearing lakes, were also recommended for the monitoring program owing to their importance to fishery resources.

Acidification of precipitation is controllable at source by cleansing gaseous emissions and is an option to be considered in design of the combustion facilities at Hat Creek. Such cleansing methods are being used more and more in Canada and the United States.

In the fall of 1977 it was found that the aquatic weed, Eurasian water milfoil (*myriophyllum spicatum*), was growing in Cultus Lake and near the mouth of Vedder Canal. The weed was also observed in Sweltzer Creek. Eurasian milfoil has previously been found along the shoreline areas of lakes in the Okanagan Valley where its presence has prompted studies of means of control or eradication. Provincial authorities are now considering control of the weed in Cultus Lake also.

Observations by Commission personnel indicate that so far the spawning grounds in Cultus Lake and Sweltzer Creek are not being affected by Eurasian milfoil, although the weed is growing in adjacent areas. The Commission will be examining the situation in Cultus Lake with Fisheries and Marine Service and will conduct research relevant to proposals for controlling Eurasian milfoil to assure sockeye and pink salmon are protected.

A spill of bunker fuel oil from storage tanks into the Fraser River at Steveston occurred during the night of August 29-30. Tide and river currents distributed the oil into Georgia Strait. Aerial inspection revealed that oil had spread to the outer edges of the Fraser River plume by mid afternoon. The oil continued to spread southward into United States Convention Waters and the Commission closed certain fishing areas in both countries temporarily to avoid fishing operations in the affected waters. Fish collected during test fishing were examined for oil contamination but none was evident and there was no off-odor. The oil spill at Steveston was small compared to the amount that could be spilled from a tanker. It is evident that a large spill during the fishing season would pose severe problems for the fishing industry and for management of the runs.

In connection with a ski development at the headwaters of Sakwi Creek, a water quality monitoring program was started in the fall of 1977. Observations have shown that siltation occurred in Sakwi Creek during rainfall. Sampling at the ski area during wet weather showed that turbidity in Sakwi Creek was low

upstream of the developed area but very high downstream. The Commission and the Fisheries and Marine Service participated in an interagency committee to review the site drainage plans, with a view to minimizing potential effects on salmon spawning grounds downstream in Weaver Creek. The fisheries agencies have recommended that expansion plans for the ski area for 1978 be delayed pending correction of siltation problems through implementation of an acceptable drainage plan.

Inspection and photographic records indicated algae growths in the Thompson River in September and October were similar to those observed in previous years by the federal-provincial Thompson River task force. That study attributed discharges of phosphorous from the pulp mill lagoon and municipal sewage stabilization ponds at Kamloops as significant factors in the algae growth. The task force recommended significant reductions in discharge of phosphorous from these two point sources. It was reported in the 1976 Annual Report that phosphorous and nitrogen were no longer being added to the aerated lagoon at the pulp mill, and the City of Kamloops has initiated a program to remove phosphorous from municipal sewage by applying alum to the stabilization ponds.

Subsequent measurements showed phosphorous occurred in the effluent from the pulp mill aerated lagoon owing to inputs from various processes in the mill. At the sewage lagoons, phosphorous was lost to the Thompson River via exfiltration. Methods of upgrading phosphorous removal at the municipal sewage lagoons were under study in 1977.

In a cooperative project with Environment Canada's Inland Waters Directorate, samples from the Fraser River, selected tributaries in the Fraser Valley draining agricultural areas, and municipal sewage were cultured for *Flexibacter columnaris*, the bacteria which causes columnaris disease among adult sockeye. Samples were collected twice during migration of adult sockeye and were negative except for one sample from the Fraser River at Rosedale.

A survey of dissolved atmospheric gases was conducted in the Fraser, Thompson and Horsefly Rivers, and McKinley Creek during migration of adult sockeye. Total dissolved gas content in the Fraser River between Hope and Lillooet varied between 109 and 113% on a dry air basis. Total dissolved gas content in the Thompson and Horsefly Rivers and McKinley Creek ranged from slightly above 100% saturation to slightly below. It was concluded that the combination of supersaturation and duration of exposure experienced by adult sockeye in the rivers tested was less than the lethal threshold. However, in view of the level of supersaturation in the Fraser River, future developments in the watershed must be examined in light of their possible impact on supersaturation as well as other environmental effects.

As in the past, samples of plankton obtained by Weyerhaeuser Canada from Kamloops Lake were forwarded to the Commission for measurement. This sampling program will be conducted in even years only in the future, as recommended by

the Thompson River task force report. Measurements of turbidity, pH and conductivity of the Fraser River at Hell's Gate were continued. The program of obtaining baseline water quality data in the Nadina River and tributaries was continued in expectation that logging would commence in 1978.

ENGINEERING

As a result of the large number of fish returning to the Weaver Creek spawning channel in recent years, it has been found necessary to improve the facilities for diverting fish past the channel so that they can utilize natural spawning areas in Weaver Creek adjacent to, and upstream from, the spawning channel. The spawning channel was designed for sockeye salmon and 5000 sq yd of additional area was provided for chum and pink salmon that were expected to enter the channel along with the sockeye. In recent years, not all of the returns of sockeye, chum and pink salmon could be accommodated in the channel. In 1976, the excess chums were manually removed, but this was not a satisfactory method. A species sorter was installed in 1977 that enabled all excess spawners to swim out of the lowest leg of the channel and to return to Weaver Creek upstream from the barrier fence at the entrance to the spawning channel. These diverted fish are not removed from the water or handled in any way. Using up to four swing gates, operators are able to direct the fish into an open channel and pipeline through which they swim to reenter Weaver Creek. These facilities handled 9522 fish in 1977 with no operational difficulties. Most of the diverted fish migrated to good spawning areas in Weaver Creek upstream from the Weaver-Sakwi confluence.

Improvements were also made at the Gates Creek spawning channel in efforts to overcome minor operational problems. During high water, some of the bedload carried by Gates Creek is swept into the intake screen chamber and gravel is also deposited in front of the intake where it interferes with flow into the intake at low water levels. To alleviate these problems, additional intake area was provided and a second gate was installed for sluicing bedload materials past the intake screen chamber. The barrier fence, which is used for diverting fish out of Gates Creek into the spawning channel, was improved by rechanneling the flow to provide more attractive entrance conditions to direct sockeye toward the spawning channel.

Ice formation in the fishway at the lower end of the Gates Creek spawning channel has caused operational problems during severe weather conditions by partially damming the channel. To alleviate this problem, a branch was installed on the existing pipeline from Anderson Lake so that water pumped from below the thermocline in the lake could be discharged when required at the downstream end of the channel for melting any accumulated ice.

A major maintenance job was required at the Weaver Creek spawning channel for repairing flood damage caused by a flash flood in Sakwi Creek that occurred on November 1, just prior to the end of the spawning period. Heavy rains caused severe washouts and slides on the road to a ski area at the headwaters of Sakwi Creek, which is tributary to Weaver Creek upstream from the spawning channel

site. The high discharge in Sakwi Creek brought down a large amount of forest debris which formed a log jam on the highway bridge over Weaver Creek adjacent to the upper end of the spawning channel. This log jam caused Weaver Creek to flood over the spawning channel for several hours, depositing sand and silt on the gravel over 95% of the length of the channel. Silt was deposited to depths of up to 12 inches in some areas. The flood also caused extensive bank erosion in Sakwi Creek near the water intake on this stream, and extreme bed erosion and heavy deposition of wood debris, silt, sand and gravel occurred in Weaver Creek between the Sakwi confluence and Morris Lake, a distance of 1.3 miles. The stream bed was raised to such an extent by this deposition that it was considerably higher than the adjacent ground in some areas, with the result that part of the stream bed was dry during the winter low-flow period. Sampling of the stream bed showed that there was practically no survival of eggs below Sakwi Creek. There was no flood damage in Weaver Creek upstream from the Sakwi-Weaver confluence.

All of the repair work required to restore Weaver Creek and the spawning channel to its pre-flood condition could not be completed in 1977 because of the need to avoid damaging the surviving eggs and alevin. Since no spawning had occurred in Sakwi Creek, it was possible to remove log jams, excavate much of the sand and gravel that had been deposited in the creek bed, and construct bank protection to prevent further damage to the Sakwi Creek water intake and silt settling basin. Rock riprap was placed on the bank of Weaver Creek between the Sakwi confluence and the spawning channel to repair erosion damage and to provide greater protection against subsequent floods. An attempt was made to use a suction device for removing sand and silt deposited on the gravel in the spawning channel but this proved to be impractical. After fry emergence, this gravel will be cleaned by using the previously developed spawning channel gravel cleaner. Further work will also be required in Weaver Creek to remove materials deposited in the stream bed and to provide bank protection in some areas.

Counting of sockeye migrating through a fishway over the Seton Creek dam and observations of fish in the tailrace of the Seton Creek hydroelectric plant showed that, as in past years, the migration of adult sockeye at this hydroelectric plant was again delayed. Although there was a loss of Portage Creek sockeye due to delay and injury in the tailrace, the run arriving on the spawning grounds was double the brood year. The power plant was shut down for repairs during migration of the Gates Creek run and the fish arrived in excellent condition. The escapement was 3.6 times as large as the brood year. B. C. Hydro has hired consultants to analyze proposals that have been made for overcoming the delay problem, but none of the possible solutions has yet been agreed to by B. C. Hydro. It has been found that fish delay can be reduced by a combination of plant shutdowns and large spills down Seton Creek, and it will be necessary to continue with this and possibly other measures, pending implementation of permanent remedial measures.

Commission staff spent considerable time in 1977 analyzing and supplying data to B. C. Hydro's consultants to aid in preparation of environmental impact statements for the McGregor River diversion. After the year end, B. C. Hydro announced the project had been shelved. Many discussions were held with B. C. Hydro and its consultants concerning the proposed water intake in Thompson

River for the Hat Creek thermal plant. Approximately 82% of the pink salmon utilizing Thompson River spawning areas in 1977 spawned upstream from the proposed intake. A report on distribution of spawners in relation to the water intake site was prepared in collaboration with B. C. Hydro. The design of the proposed water intake has been discussed in detail with B. C. Hydro and it is considered that this part of the Hat Creek project will not have an adverse effect on sockeye or pink salmon production.

In cooperation with the Fisheries Service and the Department of Public Works, studies were made to determine the extent of pink salmon spawning in areas of the main stem of the Fraser River where dredging and gravel removal are sometimes required. There was no dredging or gravel removal this year in the 30-mile-long spawning area in the Fraser River between Mission and Hope.

Techniques have been developed and tested over the past six years to enable *in situ* cleaning of spawning gravel in natural spawning areas and in spawning channels. The 2-mile-long Nadina spawning channel was cleaned this year prior to the spawning of approximately 16,000 sockeye in the channel. Measurements of the silt content in the other channels showed that only the Nadina channel needed cleaning this year.

Areas of the natural spawning ground in Nadina River that had been cleaned in 1975 and 1976 were surveyed again this year to determine the number of years the benefits of cleaning persist. The objective in cleaning spawning gravels in natural rivers is to produce a spawning medium similar to that provided in artificial spawning channels. This objective has been achieved, but the experiments have shown that because of the large amount of bedload movement, frequent 're-cleaning' of this spawning area would be required. After being exposed to two annual floods, one half of the length of the Nadina riverbed cleaned in 1975 has now reverted to the original condition of relatively low permeability. Continuation of cleaning in the Nadina River is considered impractical until there is a substantial increase in the number of Early Nadina spawners, as the few existing spawners are not attracted to the clean gravel and only random use is made of the clean gravel. Possibly the technique may have application in heavily used spawning grounds.

Pink salmon spawned in the Vedder River in 1977 in areas that had been extensively dredged and worked over in 1976 following the severe flood in December 1975. The population was only 48,561, considerably lower than in 1975. The fish spawned primarily in the section of the river that had been dredged and redyed, and did not use the portion of the river between Vedder Crossing and the upper end of the dredged area. The survival of eggs deposited in this dredged area will be measured in the spring of 1978.

It is anticipated that the joint federal-provincial board will approve expenditure of funds in 1978 for construction of set-back dykes that will provide greater flood protection to adjacent lands and eliminate much, if not all, instream activity to maintain the flood-carrying capacity of Vedder River.

TABLE I
SOCKEYE CATCH BY GEAR

Gear		1965	1969	1973	1977
<i>United States Convention Waters</i>					
Purse Seines	Units	153	183	151	212
	Catch	740,123	991,598	1,410,499	822,995
	Percent	72.13	62.51	53.68	45.99
Gill Nets	Units	432	519	725	1,021
	Catch	236,133	517,650	1,075,698	899,757
	Percent	23.01	32.64	40.94	50.28
Reef Nets	Units	55	44	48	53
	Catch	49,707	76,570	140,921	65,984
	Percent	4.84	4.83	5.36	3.68
Troll	Catch	155	358	463	873
	Percent	0.02	0.02	0.02	0.05
TOTAL CATCH		1,026,118	1,586,176	2,627,581	1,789,609
<i>Canadian Convention Waters</i>					
Purse Seines	Units	67	89	129	110
	Catch	85,914	340,187	1,126,314	448,214
	Percent	8.27	20.30	43.67	22.74
Gill Nets	Units	1,211	1,082	1,178	980
	Catch	944,266	1,268,525	1,395,085	1,487,900
	Percent	90.87	75.71	54.10	75.48
Troll	Catch	9,015	66,824	57,571	35,039
	Percent	0.86	3.99	2.23	1.78
TOTAL CATCH		1,039,195	1,675,536	2,578,970	1,971,153

NOTE: Gear counts represent the maximum number of units delivering sockeye on a single day near the peak of the run.

TABLE II

CYCLIC LANDINGS AND PACKS OF SOCKEYE
FROM CONVENTION WATERS

	<i>United States</i>	<i>Canada</i>	<i>Total</i>
1977			
Total Landings (No. Sockeye)	1,789,609	1,971,153	3,760,762
Share in Fish	47.59%	52.41%	
Total Pack (48-lb Cases)	158,972	181,591	340,563
Share in Pack	46.63%	53.32%	
1946-1977			
Total Landings (No. Sockeye)	53,906,699	52,932,486	106,839,185
Share in Fish	50.46%	49.54%	
Total Pack (48-lb Cases)	4,742,290	4,658,565	9,400,855
Share in Pack	50.45%	49.55%	
1977 Cycle Catch			
1977	1,789,609	1,971,153	3,760,762
1973	2,627,581	2,578,970	5,206,551
1969	1,586,176	1,675,536	3,261,712
1965	1,026,118	1,039,195	2,065,313
1961	1,378,392	1,357,099	2,735,491
1957	1,639,265	1,360,760	3,050,025
1953	2,032,437	1,992,343	4,024,780
1949	1,056,792	1,020,799	2,077,591
1945	706,464	969,444	1,675,908
1941	1,558,554	2,116,723	3,675,277
1937	897,022	1,075,986	1,973,008
1933	1,724,127	726,309	2,450,436
1929	1,334,141	725,037	2,059,178
1925	1,375,012	453,704	1,828,716
1921	1,199,929	486,312	1,686,241
1917	5,005,609	1,877,792	6,883,401
1913	21,736,398	9,606,641	31,343,039
1909	13,664,988	7,261,486	20,926,474
1905	10,330,277	10,350,959	20,681,236
1901	13,694,032	12,065,999	25,760,031

NOTE: Pack figures include all sockeye landed even though some were sold fresh and frozen.

TABLE III
DAILY CATCH OF SOCKEYE, 1965-1969-1973-1977 FROM UNITED STATES CONVENTION WATERS

Date	JULY					AUGUST					SEPTEMBER				
	1965	1969	1973	1977		1965	1969	1973	1977		1965	1969	1973	1977	
1															
2		6,906	110,423			3,137		242,792	14,338				12,031		13
3		4,731	80,632			1,445	122,566					4,142	7,085		
4			75,761			52,146	77,758					3,683	3,912		
5	26,335			230,143		65,290	63,332								
6	21,773			98,478											302
7		1,824		18,638											15
8		1,931		39,389											
9		2,324	153,802			55,149		249,821							
10			78,082			30,297									
11			77,654			14,893	42,399						18		
12			60,972				18,044						78	1,429	
13	20,836						15,558						981	484	
14	15,456		47,993				12,433						266	126	
15		16,173		119,339											
16		9,948													
17			85,708			13,584		102,899	2,723						
18			40,820			8,584		39,203	61,433			191			18
19			43,260						31,546			30			
20	43,747						17,370					2	49		
21	74,983						23,237						22		
22	84,674	221,188						84,981							22
23		156,203	130,363					58,765	776						1
24		182,627	79,529					33,417	17,032						4
25			69,739	26,703				10,132	7,411						
26				386,882					5,522					6	
27				16,671					82					9	
28									59						
29	262,812	230,072						30,423							346
30	172,566	201,102						13,494							226
31		92,332	287,354	15,296					92			1,004			120
			279,495	241,105					5,446			294			
									1,414						
Totals	723,182	1,127,361	1,691,587	1,192,644		256,116	429,636	865,927	351,748		1,751	11,618	25,153	1,067	
Troll	104	131	285	377		46	210	108	492		1	1	1	0	
Monthly Totals	723,286	1,127,492	1,691,872	1,193,021		256,162	429,846	866,035	352,240		1,752	11,619	25,154	1,067	
June and Oct. Totals											44,918	17,219	44,520	243,281	
Season Totals											1,026,118	1,586,176	2,627,581	1,789,609	

TABLE IV
DAILY CATCH OF SOCKEYE, 1965-1969-1973-1977 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1965	1969	1973	1977	1965	1969	1973	1977	1965	1969	1973	1977
1		10,842										
2		10,654	77,811		206,017		140,333	254,774		1,272	2,157	205
3			27,430		79,921		108,960	49,889		709	1,489	
4			16,248	216,751	29,092	178,581					25,190	
5	35,176			97,485		81,629						53
6	8,184		Strike			51,902						19,158
7			July 6-									
8			July 15									
9		5,363	32,772		20,830		50,062	45,446	133	286		17,653
10					63,820		36,412	37,489	106	163		
11					24,820		150,843	49,295	59	177	97	
12	19,440					34,096	61,480	66,984		287	11,213	
13	5,750					62,362					70	
14		22,096		68,514		15,882	57,682		27		37	25,675
15			26,786	22,076			138,703		10			26,723
16			12,961		9,770		105,299	96,228	9			
17			8,966		26,163			11,790	11			
18			10,905		4,618					45	7,972	
19	73,372					8,471				16	4	
20	22,946					4,830					7	
21	13,577					13,310			4,335			9,328
22		96,953		95,756			93,807		8			
23		30,593		31,816			26,584	20,032	3			
24			243,444				26,578	2,928		15		
25			150,685				11,668	1,142		35	2,595	
26			112,045	351,221	6,790						22	
27			43,025		1,481	5,907					13,637	
28	179,102	368,974					31,894		18			
29	69,415	229,115					7,784		3			
30	76,955	160,326					11,313	5,771	3,182	18		
31	10,080	91,292	150,434		4,562	1,159						
		79,400	215,403			1,160		369				
Totals	513,997	1,105,608	1,085,890	926,644	477,834	459,289	1,323,864	812,789	7,904	3,023	64,490	98,795
Trawl	6,687	43,240	24,079	17,012	2,183	18,802	28,890	13,699	50	4,419	3,574	1,715
Spring Salmon												
Gill Nets		3,079							569	8,288	1,769	517
Monthly Totals	520,684	1,151,927	1,109,969	943,656	480,067	478,091	1,352,754	826,488	8,523	15,730	69,833	101,027
June, Oct. and Nov. Totals									29,921	29,788	46,414	99,982
Season Totals									1,039,195	1,675,536	2,578,970	1,971,153

TABLE V
INDIAN CATCH OF SOCKEYE BY DISTRICT AND AREA,
1973 and 1977

<i>District and Area</i>	1973		1977	
	<i>Catch</i>	<i>No. of Fishermen*</i>	<i>Catch</i>	<i>No. of Fishermen*</i>
HARRISON-BIRKENHEAD				
Birkenhead River and Lillooet Lake	4,075	40	14,050	1
TOTALS	4,075	40	14,050	1
LOWER FRASER				
Below Hope	44,126	212	69,252	424
TOTALS	44,126	212	69,252	424
MIDDLE FRASER				
Hope to Lytton	45,255	390	71,130	} 1,115
Lytton to Churn Creek	37,225	681	53,070	
TOTALS	82,480	1,071	124,200	1,115
CHILCOTIN				
Farwell Canyon to Siwash Bridge	1,495	} 92	7,321	} 88
Keighley Holes	200		1,144	
TOTALS	1,695	92	8,465	88
UPPER FRASER				
Churn Creek to Quesnel	8,700	172	12,589	199
Shelley	735	30	530	28
TOTALS	9,435	202	13,119	227
NECHAKO				
Nautley and Stella Reserves	4,880	48	5,698	55
TOTALS	4,880	48	5,698	55
STUART				
Fort St. James-Pinchi Village	7,421	41	4,874	52
Tachie, Takla and Trembleur Villages	7,701	58	5,410	67
TOTALS	15,122	99	10,284	119
THOMPSON				
Main Thompson	900	19	500	20
North Thompson	65	5	—	—
South Thompson	125	192	60	5
TOTALS	1,090	216	560	25
GRAND TOTALS	162,903	1,980	245,628**	2,054

* Number of permits issued to Indians in district.

** Does not include 900 fish taken in Area 20.

The Indian catch statistics detailed above are obtained from the Canada Department of the Environment, Fisheries Service. Their officers control the taking of sockeye by the Indian populations residing throughout the Fraser River watershed.

TABLE VI

* Totals include small numbers of fish in small tributaries not listed in the table.

TABLE VII

DAILY CATCH OF SOCKEYE, 1962-1966-1970-1974 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1962	1966	1970	1974	1962	1966	1970	1974	1962	1966	1970	1974
1					25,695	131,250					31	
2					16,883	104,089					6	
3									142			55,431
4						104,338	79,718		897			
5						56,763	43,413		553	8,986		
6						73,479	35,355		37,491	4,292		
7					32,790			234,490	17,758	9,196	549	
8					38,759			142,942		4,756	301	
9					42,145	76,199					671	12,421
10						66,840					275	6,988
11						40,163	70,672		331			5,044
12		2,317				45,066	55,718		4,921			
13		1,968				51,407	59,364	105,239	5,584	3,262		
14			4,133		41,499	26,894	67,530	139,059	542	980		
15			1,716		13,444		48,662	103,232		1,686	11,940	
16				8,175		44,307		154,957		511	2,356	
17				1,776		43,556	67,087				1,373	11,730
18		6,902				51,893	89,253				168	4,321
19		6,154				22,143	94,550		452		1,722	1,450
20			14,399			17,494	73,372		1,337			
21			10,630		30,235		52,020	310,026	160	8,131		
22			14,252		52,410			216,732		11,012		
23			9,783	4,661		73,061		158,644		12,804		
24	11,312			3,997		94,884				6,364		
25	12,930										792	1,442
26	22,666										258	504
27	25,538	28,951							92		3,842	262
28		34,784							800	145		
29		41,679	47,077	100,429	183,264		234,354	308,214	93	186		
30			33,591	75,587		11,044	91,263	238,166		33	1,305	
31				55,127	52,971	6,457	49			8	1,034	
Totals	159,625	122,755	147,291	249,752	525,095	1,141,332	1,162,410	2,111,701	71,153	72,382	31,042	99,593
Troll	388	75	57	133	426	287	365	87	23		1	1
Monthly Totals	160,013	122,830	147,348	249,885	525,521	1,141,619	1,162,775	2,111,788	71,176	72,382	31,043	99,594
June, Oct. and Nov. Totals									1,927	384	9,051	408
Season Totals									758,637	1,337,215	1,350,217	2,461,675

TABLE VIII
DAILY CATCH OF SOCKEYE, 1962-1966-1970-1974 FROM CANADIAN CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1962	1966	1970	1974	1962	1966	1970	1974	1962	1966	1970	1974
1						227,815					933	13,378
2	2,469			14,984		102,476					167,484	9,823
3	6,116					44,215	84,815		85,937			79,914
4		9,042				48,348	133,926		50,972			
5		9,990						64,383	8,832	438		
6									45,204	6,858		
7									1,806	174		
8						134,957				105		
9						81,319					107	
10	22,160			29,177		57,790					5,627	
11	11,310			5,701		76,573					61	112,839
12	11,328			9,000		55,376	231,605		624	8,248		1,271
13		9,714				102,303	185,031		349	105		
14		2,539							173	16	139	135,407
15			5,562		5,801					511	239	
16												
17	12,460			7,754	33,515	46,027		32,131				1,405
18	12,708				44,504	44,504						1,712
19		8,073				48,046	94,112					
20		5,050					103,304		148	760		
21			9,883		39,664			147,866	172	71		
22			5,225		28,275			113,219		903		
23				4,838				199,353				
24				3,328								
25	22,916					70,477						
26	7,351	40,159				48,119						
27		15,177										
28			71,450					34,766	725			
29			45,779		50,144			88,440	715	530		
30			21,227	84,653	26,674		27,577	33,882	784	56		
31				94,877	33,735	1,689	4,850	235,993		7,668	150,254	
	68,666			103,943	25,720	7,233	1,975					26,041
	18,324											
Totals	195,808	99,744	159,126	358,255	335,144	1,197,267	867,195	1,324,903	249,724	18,264	333,197	381,790
Troll	790	2,603	11,353	49,208	4,417	18,950	134,009	368,553	291	35	51	7,814
Spring Salmon												
Gill Nets												
Monthly Totals	196,598	102,347	171,504	407,463	340,985	1,219,187	1,006,426	1,693,456	1,540	3,810	333,248	389,604
May, June, Oct. and Nov. Totals			1,025		1,424	2,970	5,222		251,555	22,109	30,593	9,496
Season Totals									47,261	6,511		
									836,399	1,350,154	1,541,771	2,500,019

TABLE IX

SUMMARY OF THE SOCKEYE ESCAPEMENT TO THE FRASER
RIVER SPAWNING AREAS, 1962, 1966, 1970, 1974

District and Streams	1974 Period of Peak Spawning	Estimated Number of Sockeye			
		1962	1966	1970	1974
LOWER FRASER					
Cultus Lake	Nov. 20-25	27,070	17,464	15,149	9,814
Upper Pitt River	Sept. 10-14	16,585	20,867	6,657	20,792
Widgeon Slough	Oct. 30-Nov. 2	599	884	364	1,643
HARRISON					
Big Silver Creek	Sept. 20-24	270	329	261	837
Harrison River	Nov. 12-15	8,162	32,672	12,675	16,920
Weaver Creek	Oct. 15-22	15,962	13,875	6,373	42,141
Weaver Channel	Oct. 15-20	—	6,541	4,723	24,664
LILLOOET					
Birkenhead River	Sept. 26-Oct. 1	52,146	81,134	72,760	173,463
SETON-ANDERSON					
Gates Creek	Sept. 5-10	1,046	592	68	146
Gates Channel	Aug. 30-Sept. 3	—	—	735	1,645
Portage Creek	Nov. 1-5	12,034	31,844	3,901	8,986
SOUTH THOMPSON					
Seymour River	Aug. 28-Sept. 2	58,104	28,754	11,991	45,189
Eagle River	Sept. 1-5	169	288	23	263
Scotch Creek	Aug. 28-Sept. 2	7	459	304	464
Anstey River	Aug. 30-Sept. 3	77	—	196	666
Upper Adams River	Sept. 5-10	79	63	4	13
Lower Adams River	Oct. 15-17	991,728	1,197,336	1,297,990	889,613
Little River	Oct. 21-23	67,398	55,952	168,881	122,112
South Thompson River	Oct. 21-23	14,441	4,313	5,931	14,466
Lower Shuswap River	Oct. 12-15	31,205	24,629	29,074	86,396
Middle Shuswap River	Oct. 18-22	457	1,872	4,559	3,064
Misc. Late Runs	Oct. 18-25	45,913	38,378	50,389	41,882
NORTH THOMPSON					
Raft River	Sept. 2-4	7,613	6,250	4,474	2,396
Barriere River	Aug. 26-30	14	4	2	4
North Thompson River	Sept. 24	90	46	270	343
CHILCOTIN					
Chilko River	Sept. 22-29	92,467	226,702	145,049	128,131
Taseko Lake	—	657	353	Present	—
QUESNEL					
Horsefly River	Sept. 6-10	1,001	1,607	1,350	4,459
NECHAKO					
Endako River	Sept. 1-5	236	5	0	34
Nadina River (Early)	—	450	83	78	0
Nadina River (Late)	Sept. 12-15	1,683	1,784	3,939	2,930
Nadina Channel (Late)	Sept. 15-18	—	—	—	895
Stellako River	Sept. 30-Oct. 4	124,495	101,684	45,876	41,473
STUART					
Early Runs					
Ankwil Creek	Aug. 8-11	290	86	220	707
Driftwood River	Aug. 5-9	374	140	1,983	2,462
Dust Creek	Aug. 8-11	1,035	178	963	1,214
Felix Creek	Aug. 2-6	1,600	979	2,866	4,161
5 Mile Creek	Aug. 7-11	11	0	108	349
Forfar Creek	Aug. 1-5	4,719	1,739	6,476	7,144
Frypan Creek	Aug. 8-11	243	58	130	470
Gluske Creek	Aug. 2-6	1,841	1,876	5,702	7,212
Kynoch Creek	Aug. 3-6	8,672	3,591	4,676	13,848
Narrows Creek	Aug. 1-5	666	322	144	632
Paula Creek	July 31-Aug. 4	405	0	565	2,677
Rossette Creek	Aug. 1-7	4,887	1,645	7,664	7,378
Sakeniche River	Aug. 8-11	1,035	2	0	66
Sandpoint Creek	Aug. 7-10	243	0	358	779
Shale Creek	Aug. 6-14	306	50	34	449
Misc. Streams	Aug. 7-11	389	193	858	1,988
Late Runs					
Kazchek Creek	Sept. 18-22	77	144	74	239
Middle River	Sept. 18-22	11,706	4,917	12,115	8,990
Tachie River	Sept. 18-22	6,750	3,600	2,776	4,680
NORTHEAST					
Upper Bowron River	Aug. 27-30	6,292	2,480	1,341	1,850
TOTALS*		1,624,004	1,919,286	1,943,221	1,769,366

* Totals include small numbers of fish in small tributaries not listed in the table.

TABLE X
PINK SALMON CATCH BY GEAR

Gear		1971	1973	1975	1977
<i>United States Convention Waters</i>					
Purse Seines	Units	218	268	263	266
	Catch	1,905,182	1,785,699	978,042	1,777,767
	Percent	80.30	80.26	79.04	81.98
Gill Nets	Units	507	624	902	907
	Catch	334,202	323,370	196,726	197,178
	Percent	14.09	14.53	15.70	9.09
Reef Nets	Units	48	53	56	53
	Catch	118,904	101,729	55,223	30,069
	Percent	5.01	4.57	4.41	1.39
Troll	Catch	12,863	14,126	23,164	163,416
	Percent	0.54	0.64	1.85	7.54
TOTAL CATCH		2,371,151	2,224,924	1,253,155	2,168,430
<i>Canadian Convention Waters</i>					
Purse Seines	Units	129	137	116	111
	Catch	939,737	1,246,204	639,026	807,194
	Percent	43.97	60.48	50.88	38.89
Gill Nets	Units	1,067	995	926	913
	Catch	755,663	395,901	376,511	280,674
	Percent	36.29	19.21	29.98	13.52
Troll	Catch	421,937	418,574	240,353	987,610
	Percent	19.74	20.31	19.14	47.59
TOTAL CATCH		2,137,337	2,060,679	1,255,890	2,075,478

NOTE: Gear counts represent the maximum number of units delivering pinks on a single day near the peak of the run.

TABLE XI
LANDINGS AND PACKS OF PINK SALMON
FROM CONVENTION WATERS

	<i>United States</i>	<i>Canada</i>	<i>Total</i>
1977			
Total Landings (No. of Pinks)	2,168,430	2,075,478	4,243,908
Share in Fish	51.10%	48.90%	
Total Pack (48-lb Cases)	168,797	165,616	334,413
Share in Fish	50.48%	49.52%	
1957-1977			
Total Landings (No. of Pinks)	23,488,554	22,806,320	46,294,874
Share in Fish	50.74%	49.26%	
Total Pack (48-lb Cases)	1,699,452	1,663,937	3,368,389
Share in Fish	50.45%	49.55%	
1977 Catch			
1977	2,168,430	2,075,478	4,243,908
1975	1,253,155	1,255,890	2,509,045
1973	2,224,924	2,060,679	4,285,603
1971	2,371,151	2,137,337	4,508,488
1969	945,797	861,505	1,807,302
1967	3,827,040	4,156,922	7,983,962
1965	558,380	592,467	1,150,847
1963	4,426,232	4,173,288	8,599,520
1961	508,544	545,128	1,053,672
1959	2,427,535	2,312,906	4,740,441
1957	2,777,366	2,634,720	5,412,086
1955	4,685,984	4,129,063	8,815,047
1953	4,951,429	4,142,117	9,093,546
1951	5,086,284	2,885,514	7,971,798
1949	6,235,400	3,189,662	9,425,062
1947	8,801,595	3,491,416	12,293,011
1945	5,458,890	1,279,849	6,738,739

NOTE: Pack figures include all pinks landed even though some were sold fresh and frozen.

SALMON COMMISSION

TABLE XII
DAILY CATCH OF PINK SALMON, 1971-1973-1975-1977 FROM UNITED STATES CONVENTION WATERS

Date	JULY				AUGUST				SEPTEMBER			
	1971	1973	1975	1977	1971	1973	1975	1977	1971	1973	1975	1977
1	1				240	4,907		1,040	78,550	360,059		17,172
2		100			4,882				90,063	330,814	280,698	
3		140			3,215				201,457	206,254		
4		152			1,946				189,407			1,641
5	9			220					4,666			152,848
6	9		307	203				854	328,841			10,868
7			308	71				8,841	390,632			
8	20		324	189				109	262,261			
9	4	1,067			55	14,294		8,300	294,472	53,910		
10		1,496			7,185			644	169,530	32,018		
11	1	2,615			7,161				66,887			
12	43	3,581			5,042		19,933					
13	62	3,818			4,649		16,127					
14	111			1,776								219
15	67	1,066	840	409	344	22,253	23,762	1,796	6,114	146,806		
16		5,661			7,238	15,311		46,828	144,795	132,744		
17		3,799			7,552			70,333	121,411	57,264		5,344
18		2,908			6,577				91,232	59,485		55
19	34				6,006				11,796	21,161		36
20	563				5,056				59,887			2,042
21	514				3,154				59,521			1,623
22	732		8,328		45			23,559	33,525			995
23		6,729	5,047		7,257	43,693		446,813		12,387		
24		5,110			9,171	20,293		246,590		4,707		
25		4,251		2,163	12,231			275,569				
26				4,015	13,107			21,322				
27	112			1,363	11,680			20,728				
28	2,033					249,269	137,643		1,212			743
29	1,438		12,707			138,583	91,649		19,789			780
30	2,391		8,891						6,741			243
31	2,837		7,998	422					7,948		2,431	
		6,821	8,130	4,657	5,580				6,865		866	
		5,114			92,273							
Totals	10,981	53,362	53,946	15,488	221,646	631,178	451,446	1,794,002	2,116,713	1,518,795	723,831	194,609
Troll	1,999	7,108	7,881	40,202	8,154	5,704	11,946	118,162	1,859	598	956	4,394
Monthly Totals	12,980	60,470	61,827	55,690	229,800	636,882	463,392	1,912,164	2,118,572	1,519,393	724,787	199,003
June, Oct. and Nov. Totals									9,799	8,179	3,149	1,573
Season Totals									2,371,151	2,224,924	1,253,155	2,168,430

TABLE XIII
DAILY CATCH OF PINK SALMON, 1971-1973-1975-1977 FROM CANADIAN CONVENTION WATERS

Date	JULY					AUGUST					SEPTEMBER				
	1971	1973	1975	1977		1971	1973	1975	1977		1971	1973	1975	1977	
	1971	1973	1975	1977		1971	1973	1975	1977		1971	1973	1975	1977	
1	Strike					6,406	3,396		12,490		6,913	167,083	33,756	50,134	
2	June 26-					5,243	3,452		5,713		15,269	157,615	61,793		
3	July 10					5,988					27,028	157,578			
4											13,692				
5		1		75				470			13,768				
6		Strike					24,136	199			33,997		78,851	30,598	
7		July 6-					14,643				13,768		74,730	108,270	
8		July 15	50				13,373				141,120		50,627	69,472	
9		1	11				2,572				81,037				
10						20,059		186			86,916				
11						17,280		70			50,859				
12						15,145		165			36,599				
13								121			46,851				
14							23,520				31,098				
15			18				24,987				34,631		62,355	28,051	
16	20	40				16,750					26,718		45,604	1,279	
17		90				9,010							29,163	44,759	
18		84											58,966		
19		59													
20								6,347							
21								11,200						548	
22			243				79,374	9,559			14,866			126	
23			130				71,878	14,836			7,649			9,285	
24		7,155				23,135	125,369	9,634			172,256		45,221		
25		5,601				25,979	10,591				27,182		2,800		
26		4,415	Strike	4,633		17,141						31,267			
27	192	July 25-	120			73,040		96,884					10,910		
28	57	Aug. 24				90,929	178,434	85,765			47,551	1,191	14,358		
29	217	712					131,738	94,303			8,392	34,996			
30			382				28,293				1,299				
31		2,963				224,988					29,454		11,317		
		3,472				145,573					17,488		508		
Totals	578	23,880	1,546	5,325					87,617						
Trawl	41,634	93,200	72,114	274,529		696,666	775,605	329,739	734,349		943,343	781,828	659,047	342,522	
Spring Salmon						245,984	248,042	56,040	604,639		121,281	52,393	99,598	45,067	
Gill Nets															
Monthly Totals	42,212	117,080	73,660	279,854		942,650	1,023,647	385,779	1,338,988		16,822	7,305	14,358	3,527	
June and Oct. Totals											1,081,446	841,526	773,003	391,116	
Season Totals											71,029	78,426	23,448	65,520	
											2,137,337	2,060,679	1,255,890	2,075,478	

TABLE XIV
SUMMARY OF THE PINK SALMON ESCAPEMENT TO THE
FRASER RIVER SPAWNING AREAS

<i>District and Streams</i>	<i>1977 Period of Peak Spawning</i>	<i>Estimated Number of Pink Salmon</i>			
		1971	1973	1975	1977
EARLY RUNS					
LOWER FRASER					
Main Fraser	Oct. 1-8	928,046	766,053	315,049	775,016
HARRISON					
Chehalis River	Oct. 8-12	32,178	14,300	2,356	2,613
FRASER CANYON					
Coquihalla River	Oct. 1-5	16,778	11,994	5,933	2,821
Jones Creek	Sept. 30-Oct. 7	1,304	2,544	2,645	3,350
Misc. Tributaries	Sept. 25-Oct. 7	3,298	3,549	948	3,687
SETON-ANDERSON					
Seton Creek	Oct. 11-17	267,079	181,027	209,734	341,256
Upper Seton Channel	Oct. 12-17	6,007	6,708	7,995	11,122
Lower Seton Channel	Oct. 7-10	24,882	23,602	23,874	37,163
Portage Creek	Oct. 3-6	1,456	13,983	28,454	19,904
Bridge River	Oct. 4-6	8,817	23,738	10,803	25,800
THOMPSON					
Thompson River and Tributaries	Oct. 3-10	258,203	283,385	480,350	972,941
TOTAL*		1,553,363	1,331,002	1,088,341	2,195,769
LATE RUNS					
HARRISON					
Harrison River	Oct. 8-15	73,881	196,150	180,052	126,782
Weaver Creek	Oct. 5-12	1,141	255	411	2,397
Weaver Channel	Oct. 5-12	294	640	1,201	963
CHILLIWACK-VEDDER					
Chilliwack-Vedder River	Oct. 14-18	160,511	210,799	81,137	48,561
Sweltzer Creek	Oct. 14-18	13,122	15,265	16,121	5,093
TOTAL*		250,389	423,109	278,922	183,796
GRAND TOTAL*		1,803,752	1,754,111	1,367,263	2,387,811

* Totals may include small numbers of fish in small tributaries not listed in the table.

TABLE XV

SUMMARY OF THE PINK SALMON ESCAPEMENTS TO
UNITED STATES AND CANADIAN NON-FRASER
RIVER SPAWNING AREAS*

<i>United States Spawning Areas</i>	1971	1973	1975	1977
Nooksack	40,000	75,000	36,000	25,000
Skagit	300,000	250,000	100,000	500,000
Stillaguamish	200,000	35,000	30,000	38,000
Snohomish	125,000	110,000	65,600	160,000
Puyallup	40,000	12,000	11,800	28,800
Dosewallips	45,000	25,000	5,500	16,800
Duckabush	50,000	18,000	4,500	12,300
Dungeness	46,000	47,000	24,500	35,500
Elwha	4,000	9,600	1,500	5,000
Miscellaneous	22,000	13,400	11,200	32,300
TOTALS	872,000	595,000	290,600	853,700

<i>Canadian Non-Fraser Spawning Areas</i>	1971	1973	1975	1977
Jervis Inlet	47,600	10,830	24,300	20,000
Howe Sound	23,700	135,500	105,500	2,000
Burrard Inlet	35,000	75,000	35,000	22,000
TOTALS	106,300	221,330	164,300	44,000

* These data were provided through the courtesy of the Washington State Department of Fisheries and the Canada Department of Fisheries and the Environment.

COMMISSION PUBLICATIONS, 1977

1. Annual Report of the International Pacific Salmon Fisheries Commission for 1976.
2. Progress Report 34. Resistance of Adult Sockeye Salmon to Acute Thermal Shock by J. A. Servizi and J. O. T. Jensen.
3. Progress Report 35. I. Investigation of the Prespawning Mortality of Sockeye in Chilko River in 1971 by I. V. Williams. II. Investigation of the Use of Antibiotics to Control the Prespawning Mortality of the 1971 Chilko Population by I. V. Williams and D. Stelter.
4. Progress Report 36. Evaluation of the Production of Sockeye and Pink Salmon at Spawning and Incubation Channels in the Fraser River System by A. C. Cooper.
5. Progress Report 37. Investigation of Prespawning Mortality of 1973 Horsefly River Sockeye Salmon by I. V. Williams, IPSFC; U. H. M. Fagerlund and J. R. McBride, Resource Services Branch, Canada Department of Fisheries and the Environment; G. A. Strasdine and H. Tsuyuki, Technology and Inspection Services Branch, Canada Department of Fisheries and the Environment; E. J. Ordal, Department of Microbiology, University of Washington.

STAFF

A. C. Cooper, Director

NEW WESTMINSTER

F. J. Andrew, Chief Engineer
Dr. D. J. Blackburn
O. T. Brockwell
Miss D. Chandler (to April)
P. Cheng
Mrs. D. E. Cleary (from November)
Mrs. J. Collins (August to November)
Mrs. G. Coupar
J. H. Gable
P. Gilhousen
Mrs. E. M. Green (from April)
Mrs. S. A. Heiman (from February)
H. D. Hembrough (to August)
H. K. Hiltz
L. W. Johnston
R. B. Kent
S. R. Killick, Chief, Operations
Division
D. C. Nelson
E. B. Phillips, Administrative Officer

J. Pyper
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L. V. Woods
Miss B. Woolcock (to August)

SWELTZER CREEK LABORATORY

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Miss D. R. Brock
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R. J. Cooper (from March)
J. L. Elderkin
H. J. Enzenhofer
T. W. Gjernes (to June)
R. W. Gordon
R. L. Johnson (from September)
G. Kirkpatrick (to February)
S. G. MacLellan

D. W. Martens
K. Peters (from April)
Miss G. M. Reed (from October)
Dr. J. A. Servizi, Chief, Environment
Conservation Division
E. R. Stewart (from July)
Mrs. L. J. Tinnion (to September)
K. E. Warkentin (to March)
I. V. Williams, Chief, Biology Division
W. L. Woodall (to February)

HELL'S GATE FISHWAYS
UPPER PITT FIELD STATION
WEAVER CREEK CHANNEL
GATES CREEK CHANNEL

SETON CREEK CHANNELS
CHILKO LAKE
NADINA RIVER CHANNEL

F. R. Johnston
W. E. Keillor
C. W. Miller
R. J. Cooper (to February)
V. E. Ewert (from March)
E. R. Pierce
F. G. Scott
B. A. Van Horlick

